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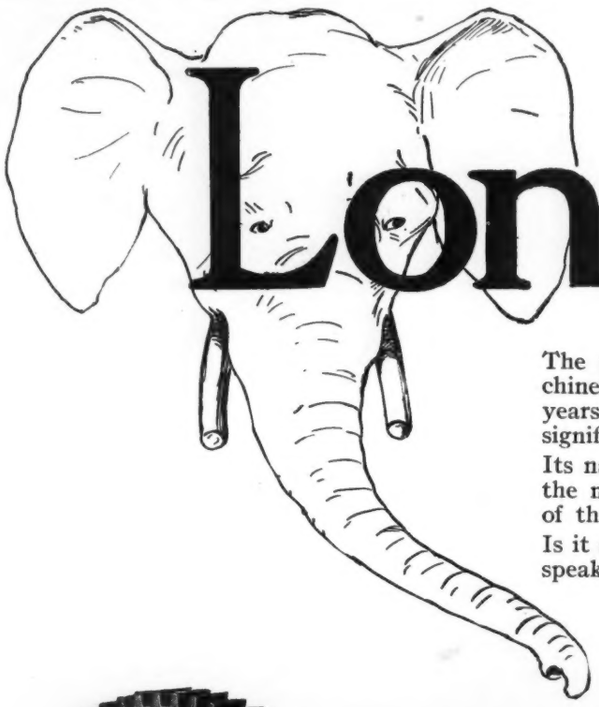

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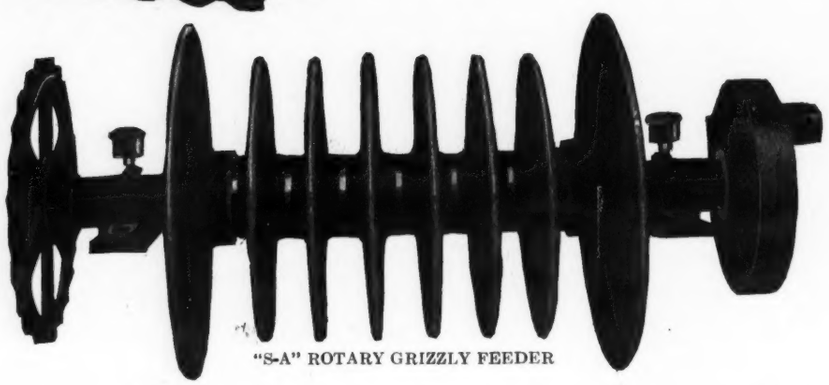

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Engineering and Mining Journal

VOLUME 102 SEPTEMBER 2, 1916 NUMBER 10

Concentration at Inspiration*--I

SYNOPSIS—As a preliminary to the construction of the 15,000-ton Inspiration concentrator, a 600-ton experimental mill was erected, primarily for the testing out of flotation. Crushing and grinding tests resulted in the selection of Symons disk crushers and Marcy ball mills. Flotation work led to the development of the Inspiration machine. Sand-concentration tests led to the adoption of double-decked Deister tables.

In planning the construction of the Inspiration concentrator, it was realized from the very beginning that with such an enormous tonnage to treat, it would be well worth the time and cost to carefully work out a flow sheet. Accordingly a gravity test mill was erected and placed in operation near the Joe Bush shaft in November, 1910, and its operation was continued until August, 1911. Soon after this, flotation began to attract considerable attention in this country, and realizing the possibilities that might arise through its systematic investigation, it was deemed advisable to go into the process in detail.

A 50-ton Minerals Separation machine was first erected, which after a few months thoroughly demonstrated that flotation was applicable to the concentration of the Inspiration ores, but in order to determine better its proper place in the flow sheet, a 600-ton test mill was designed and erected in 1913 on the benches of the concentrator site, the grading for which was at this time completed. Ore for the test mill was obtained from development work in the mine. In this mill careful attention was given all steps of the process. Several distinct types of fine and intermediate grinding machines were put through exhaustive tests, as were also classifiers, tables, flotation processes and settling and filtering systems. Numerous flow sheets were experimented with, the final result being the one now in use in the concentrator.

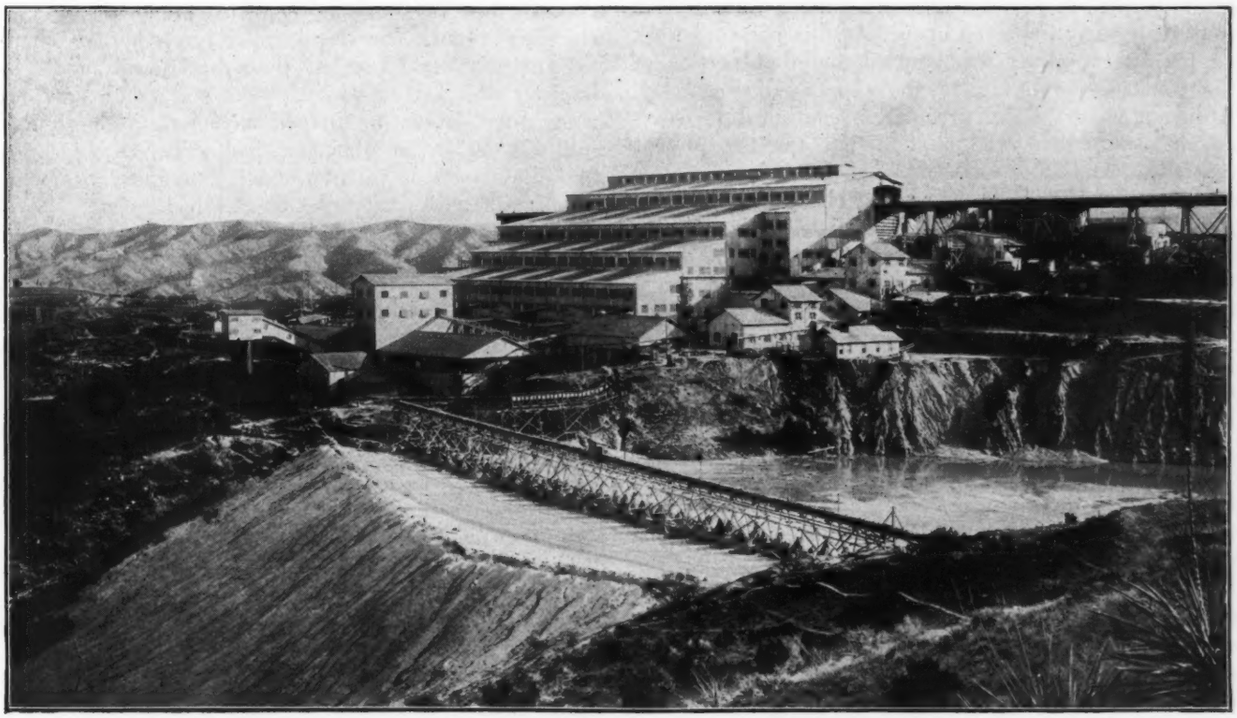


FIG. 1. INSPIRATION 15,000-TON CONCENTRATOR

That the large-scale test-mill method for working out flow sheets for large plants is the only logical method is evidenced by the fact that in nearly every stage of the treatment either an entirely new machine has been adopted or a new application of a standard machine has been made. The result in each case has been either

*Excerpt from "The Inspiration Plant, Concentrator and Other Surface Equipment," by H. Kenyon Burch, chief engineer of the Inspiration Consolidated Copper Co., Miami, Ariz., to be presented to the September, 1916, meeting of the A. I. M. E.

increased efficiency or a more economical arrangement. An interesting illustration can be made to substantiate this point. The earlier studies and results from the first test mill seemed to indicate that it would be advisable to follow stage crushing in connection with wet gravity-concentration. But in the light of later experimental work this idea was dispelled and a conclusion was reached that resulted in the adoption of finished crushing in one machine followed by a combination of flotation and gravity concentration. The following comparison will serve to impress the difference in area required by the two types of mills:

The first mill was planned to have a capacity of 7,500 tons per 24 hr. This design indicated a plant area of approximately 350,000 sq.ft., or a little over eight acres. The mill now in use covers an area of approximately 125,000 sq.ft. or a little less than three acres, but has a capacity of 15,000 tons. The recovery in the two types of plants on favorable ores—that is, ores not carrying over 10 points of oxide—may be closely estimated at 70% for the first and 85% for the second.

In order to account for the long period required for the design and construction of the plant, it may be interesting to note that six complete designs for the concentrator were executed, the idea being to keep this work abreast of the developments brought out by the test mill. Design No. 2 was completed and a contract entered into for structural-steel requirements. A portion of the steel had been fabricated when flotation developments pointed to the fact that wet gravity-concentration could be greatly improved upon. At this point all work on the steel contract was stopped and that portion of the contract pertaining to the concentrator canceled. Although facts relative to flotation continued to develop, in July, 1913, the steel design for the present concentrator building was completed. This building was no sooner erected than very marked changes in grinding machinery began to develop, the ultimate result of which was another altogether new arrangement for the entire mill. As it stands today, there are but three single pieces of machinery in the mill building occupying the places that were originally intended for them, these being the three electric cranes now in use. Considering these changes, it is quite remarkable that such a good arrangement was found possible.

Test Mill for Flotation Experiments

During the preliminary concentration work done at the 600-ton experimental mill first erected, it was constantly kept in mind that the particular method or machine under test might eventually be installed in the new mill to be built later.

The test mill was put up primarily to try out flotation on a large scale in order to determine its proper application to Inspiration ores. Since the flotation process as applied to the concentration of copper ores was an innovation, it was logical to suppose that in its last analysis the flow sheet might differ altogether from one of wet concentration methods. This did not prove to be the case, but the assumption was made and for this reason the test mill was made so flexible.

The test mill was started February, 1914. The concentrates sold at this writing have paid the expenses of erection and operation, a remarkable record for a test plant. It has treated from 600 to 1,000 tons per day, the amount depending upon the types of machines being tested.

The building is of timber, covered with corrugated steel. This type of building was chosen because it would facilitate changes or additions, was the cheapest and quickest form of construction and would still have considerable value when dismantled. All machinery was placed on concrete foundations.

The ore for the test mill was taken from a development shaft and reduced to 3-in. cubes in a No. 8 gyratory crusher located near-by, the crushed ore being loaded into cars which emptied into a 180-ton bin at the head of the test mill. The following description gives the way the mill was first run, the various additions and changes being noted in sequence:

Two 30-in. apron feeders delivered ore from the bin to an inclined 20-in. belt conveyor, which was equipped with a recording weighing machine and a magnetic head pulley. This conveyor delivered the ore to a 36-in. Symons horizontal disk crusher and a Symons 48-in. fine reduction disk, or vertical disk crusher. These two machines delivered to a second 20-in. inclined conveyor. If so desired, the two crushers could be bypassed, the delivery then being made direct to the second conveyor. This permitted the crushers below the second conveyor to be tried either as primary or secondary machines. The second conveyor delivered the ore to another 48-in. fine reduction disk and a Symons 48-in. roller mill. Water could be added either above or below these crushers. The ore then went to four Hardinge mills, the feed to which was regulated within suitable limits by a mechanical distributor. Three of these mills were 8 ft. in diameter with barrels 36 in., 44 in. and 72 in. long, all being direct-driven by induction motors. The fourth mill was 10 ft. in diameter, had a barrel length of 28 in. and was belt-driven. All these machines were pebble mills with either silex or El Oro linings.

Flexible Arrangement of Test Mill

A drag classifier followed each mill, the whole floor being so arranged that each mill could be placed in a closed circuit with its drag, or two mills and their drags run in tandem; that is, the first mill discharged into a drag, whose sands were delivered into the second mill, which in turn discharged into the second drag. The sands from the second drag were returned to join the sands from the first drag to form the feed for the second mill. The overflows from the drag were either delivered to eight sand tables by two distributors or sent to other distributors which fed eight slime tables at the lower end of the mill.

Between the sand and the slime tables were placed the flotation machines, which could be fed directly from the drag overflows or by any table product. The original installation consisted of two Minerals Separation 8-compartment flotation machines, one of 50-ton and the other of 600-ton capacity. By means of elevators any flotation product could be re-treated on the slime tables or in the small flotation machine. The concentrates from the tables and flotation machines went to a filter plant containing an Oliver and a Trent filter. The dried concentrates were loaded into one-ton cars, weighed and dumped into a railroad bin from which they were taken to the smelter. Mechanical samplers were installed at important points and hand samples taken where necessary.

The crushing and grinding experiments were not only extensive but proved most interesting, the results being quite unexpected. The 36-in. disk crusher was the forerunner of the 48-in. disk crushers now installed following the gyratories in the crushing plant situated at the mine.

As secondary or intermediate crushers—that is, machines between the 36-in. Symons disk and the Hardinge mills—the following were tried out: The Symons 48-in. fine reduction disk; the Symons 48-in. roller mill; the Symons 56x48-in. ring mill; the Bradley 66-in. centrifugal roller mill; the Overstrom centrifugal crusher; the Allis-Chalmers No. 4 hammer mill; and the Marcy ball mill.

The final results indicated that the Symons fine reduction disk with a little redesigning, would be a very efficient machine for the limited field of crushing from 4-in. cubes to 4-mesh. It was found that this could be done with a single pass, no oversize resulting. The machine would not work well wet, and it was found necessary to remove all fines from the feed to the machine, otherwise a packing would occur. Consumption of steel wearing parts appeared low as also did power consumption, although no definite data on these two points were secured.

The Marcy mill also proved to be a most excellent intermediate crusher, handling as high as 800 tons of 3-in. feed and under to pass an 8-mesh screen without return of oversize.

To compete with the four Hardinge mills a 6x20-ft. Chalmers & Williams tube mill and an 8x5-ft. ball mill were installed. The latter, a Marcy mill using 5-in. diameter steel balls, was placed in a closed circuit, as were the pebble mills, and gave very good results. It was next tried on a feed from the 36-in. disk crusher and then on a feed direct from the gyratory. These experiments definitely demonstrated that only three reductions were necessary—a gyratory, followed by a disk crusher and ball mills in a closed circuit. This is the arrangement now installed in the present plant.

Several different classifiers were tried in the ball-mill circuit, a duplex Dorr classifier finally being adopted.

The flotation machines and the tests conducted on them are described in another paper,[1] but it is interesting to note here that the following machines were tried out: Minerals Separation, Hoover and Hebbard types; the Callow flotation cells; the Cole-Bergman; and the Inspiration machines.

The Inspiration machine was devised during the operation of the test mill.

The newly built concentrating plant is equipped as follows: Four units with the Callow machines; thirteen units with the Inspiration machines; and one unit with a Minerals Separation machine.

The drag classifier originally tried out proved to be too small for the tonnage required, the drag now in the concentrator having been developed from the small one.

The tables tested were the Deister double-deck slimers, double-deck sand tables and four-deck slimer; the Deister single-deck slimer, double-deck sand table and No. 4 sand machine; and the Wilfley No. 6 table with decks arranged for both sand and slime. The Deister double-deck sand table was adopted, 198 being installed.

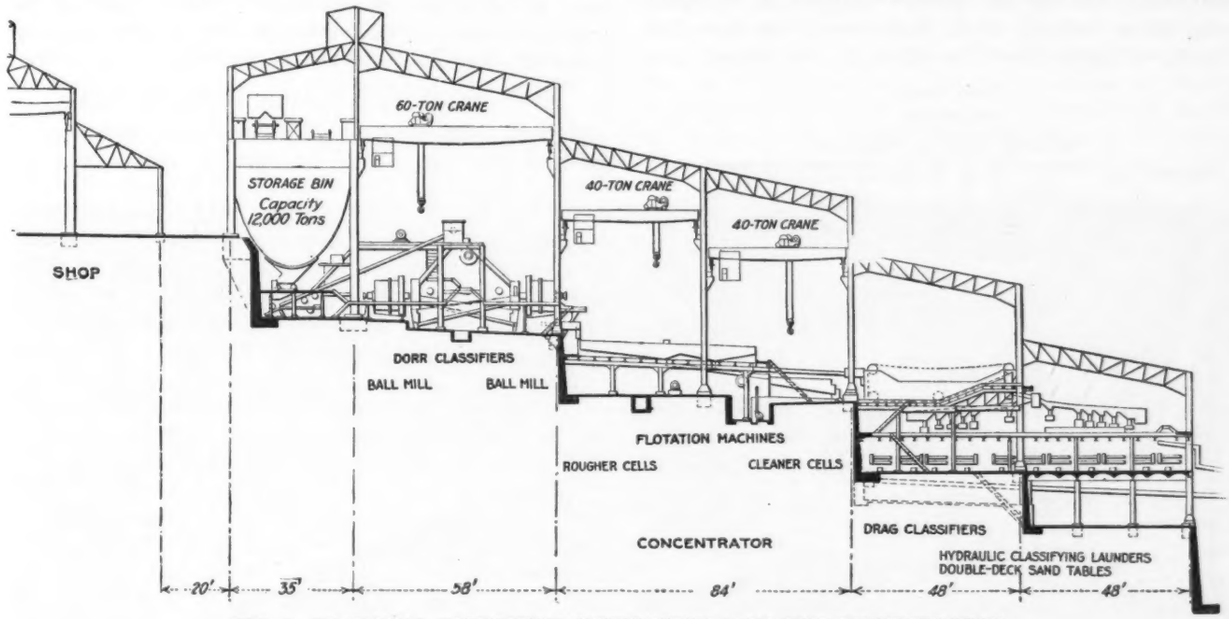


FIG. 2. SECTIONAL ELEVATION, INSPIRATION 15,000-TON CONCENTRATOR

This sketch of the test mill necessarily cannot attempt to describe tests of the many small things experimented with, such as shaking screens, Caldecott cones, samplers, feeders, slopes of launders and conveyors, or the necessary efforts to work out improvements on the new machines.

The ore from the mine crushing plant is hauled in 14-car trains to the concentrator over the trestle shown in Fig. 1, and is dumped into the bins, which have a capacity of 12,000 tons, or 670 tons per unit. These bins, best shown in Fig. 2, are of the suspension type, are filled from the double tracks above and extend the full length of the mill, 300 ft. The mill is made up of 18 units, similar in equipment except for the differences in the flotation department. Eighteen 30-in. apron feeders on the center line of the bin feed the ore to 20-in. inclined conveyor belts traveling at 150 ft. per min. Weightometers installed on these belts record the

[1] "History of the Flotation Process at Inspiration," by Dr. Rudolph Gahl, September, 1916, "Bulletin," A. I. M. E.

amount of ore fed to each unit. The conveyors discharge into hoppers where a split is made, half of the feed going to the north ball mills and half to the south mills, the transfer being made through launders with cast-iron liners and having a slope of 45°.

The ball mills are direct driven through herringbone gears by 225-hp. induction motors. There are two ball mills to each unit, which, with two 6x27-ft. duplex Dorr classifiers, form a closed circuit on oversize. The mills have a diameter of 8 ft. and a barrel length of 6 ft. Owing to some irregularities in starting up the new plant, the work of the ball mills has been somewhat uneven, but it is expected that the final product, or overflow from the classifiers, will run about 1½% on a 48-mesh screen.

Outline of Concentrator Flow Sheet

The mills are symmetrically arranged about a center line passing through the conveyor hoppers, the classifiers being placed between them. Reference to the flow-sheet, Fig. 3, will make clear the following description: The

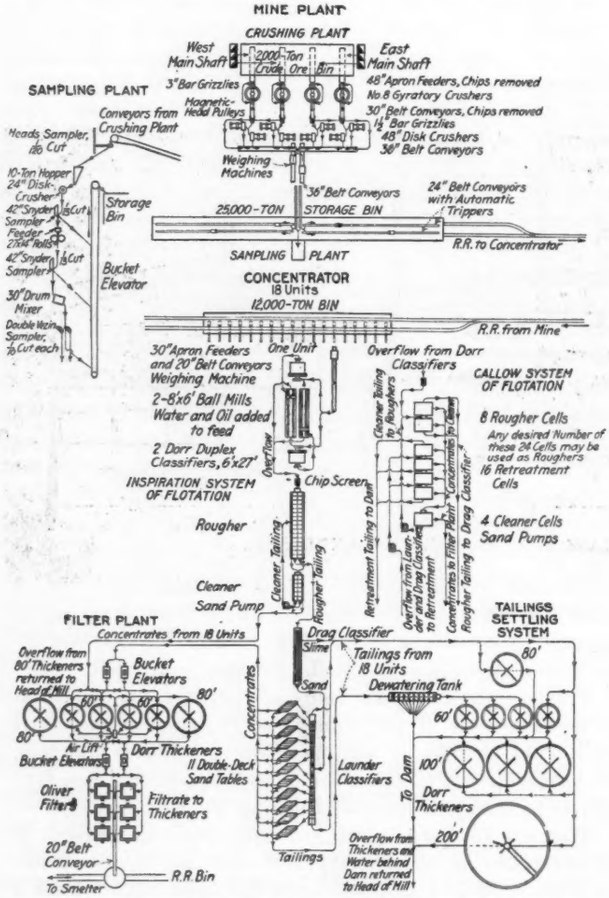


FIG. 3. FLOW SHEET OF ONE UNIT, INSPIRATION CONCENTRATOR

feed for each mill consists of ore from the bin, together with the sand from the discharge of the mill opposite, the final product of the system being the overflow of the classifiers. Each mill handles about 35 tons per hour. The feed to the ball mills has a consistency of about 1 to 2, and the overflow from the classifiers about 3 to 1, the latter ratio being maintained by an automatic device which adds water as required in the discharge boxes of the ball mills.

The overflow from the Dorr classifiers goes to the flotation machines, shown in Fig. 4, of which there are three types now in operation. Generally speaking the flotation machines make a clean concentrate which goes to the filter plant, a middling which goes to drag classifiers, and a tailing which goes to waste.

The sands product from the drag classifier goes to launders equipped with hydraulic sorting columns which furnish a classified feed for 11 double-deck sand tables, shown in Fig. 5. These tables make two products, the concentrates joining the flotation concentrates in the filter plant and the tailings going to waste. Further treatment of a middling product from these tables is contemplated, and studies have been made along this line, but as yet no definite decision has been reached. Throughout the mill adequate provision has been made for sampling. As the subject of flotation is to be taken up in detail in another paper, just enough will be given here to bring out the part the process plays in the general scheme. The flow sheets for the two processes differing somewhat, each will be considered separately.

Flow Sheet with Callow Flotation Cells

A unit installation of these machines consists of a total of 28 cells, which for sake of compactness are grouped into sets of four cells each, individual cells being 3 ft. 3½ in. by 10 ft. 2 in. Of this total, 8 are roughers, 16 are used for re-treatment, and 4 are cleaners, the arrangement of the group being such that all feeds and products except two are handled by gravity. These two are elevated by sand pumps. The Callow cells as installed in this plant make two products, a concentrate and a tailing.

The overflow from the Dorr classifiers between the ball mills first undergoes a roughing treatment in the eight roughers. Here the two products are a concentrate which goes to the four cleaners and a tailing which goes to a large, specially designed drag-classifier, a detailed description of which will be given later. The concentrate from the cleaners is a finished product and goes to the filter plant. The tailing from these cells is pumped back into the rougher cells for a second passage through the system. The tailing from the rougher cells is classified in the drag classifier into two products, a sand and a slime overflow, the sand being still further prepared for table concentration in hydraulic classifiers. The overflows from both the drag and the hydraulic classifiers are united and pumped back to the 16 retreatment cells, the concentrate from which goes to the cleaners and the tailing to waste.

Flow Sheet with Inspiration Flotation Machines

Except for a special arrangement in one unit, the only difference, between units using Inspiration machines and those using Callow machines is found in the flotation department. From a metallurgical standpoint the difference here it not radical. In a few words the essential difference can be stated as follows:

The Inspiration system makes use of but two machines per unit, a rougher and a cleaner placed end to end, as clearly shown in Figs. 2 and 4. These are each designed to allow a free passage of the feed from the upper, or feed, end to the tailing, or discharge, end, during which passage the feed is subjected to the frothing action of several compartments. Because of the large number of compartments (16 for the rougher) it has been found

that a tailing can be made, whose slimes do not require re-treatment as is the case in the Callow system. The sands contained in the rougher tailing are subjected to table concentration. The tailing from the cleaners is pumped back to the roughers for a second treatment.

Several mechanical features have been introduced that are expected to keep the cost of operation at a minimum. The arrangement is simple, requires a minimum of floor space and is easily attended. The very large capacity attained is an important feature.

Both the flotation and table concentrates receive the same treatment. From the concentrator they are either elevated or flow by gravity into the five 60-ft. and three 80-ft. Dorr tanks, placed on both sides of the elevator house. Here the moisture content is reduced to about 50%. The thickened product is drawn off through the bottoms into launders and conveyed through tunnels to bucket elevators, which raise it to the top of the elevator house, where it is distributed to six Oliver filters.

The overflow from the Dorr tanks is practically clear and flows to the return-water sump. The filters are of standard Oliver type, the drums being 11 ft. 6 in. in diameter and 12 ft. long. After leaving the filters the concentrates have a moisture content of about 17%. The arrangement is such that a single 20-in. conveyor belt traveling at 100 ft. per min. takes the concentrates away from the filters and delivers them to a railroad bin of the tank type, seen at the lower end of the mill in Fig. 1. Here they are loaded into hopper-bottomed steel cars of 60-ton capacity. A 350-ft. train shed protects the loaded cars from heavy rains and winds.

(*To Be Concluded*)

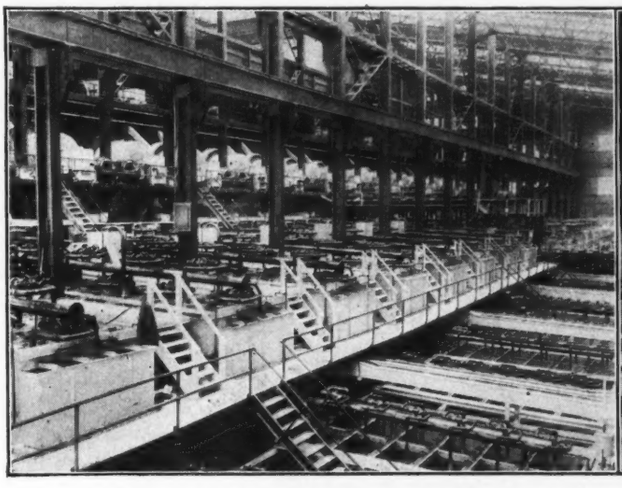


FIG. 4. FLOTATION SECTION OF MILL

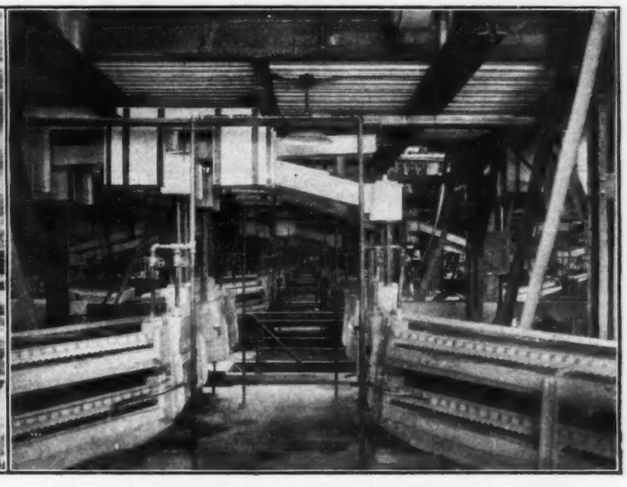


FIG. 5. DOUBLE-DECK DEISTER TABLE FLOOR

Transactions Between Mine Co-Owners

By A. L. H. Street*

Although it is a general rule of law that, in negotiating with each other for sale of their interests, an owner of an interest in mining property owes a duty to his associate not to conceal any material fact bearing on the value of the property which both as coöwners are equally entitled to know, the Arizona Supreme Court holds that one who deeded his interest in mining property to his associate was not entitled to rescind the conveyance merely because the latter concealed the result of development work that increased the speculative value of the property, where such work disclosed no new or different condition from those already known to the conveying coöwner. (Richardson vs. Heney, 157 Pacific Reporter, 980.)

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Cuban Ore Exports Increases

Cuban ore exports, all of which are absorbed by the United States increased, as reported by the United States Department of Commerce, from 1914 to 1915, as follows: Iron ore from 665,248 tons, valued at $2,261,844, to 796,830 tons, valued at $2,378,635; copper ore from 43,268 tons valued at $1,081,712, to 58,488 tons, valued at $1,794,344. Manganese ore was newly exported in 1915—5,144 tons, valued at $87,297.

Quarry Blast of 64,000 Tons

A successful blast, made at the Frazier ballast quarries, Frazier, W. Va., is reported in the Aug. 25 issue of the *Du Pont Magazine*. The blast consisted of twenty-four 5⅝-in. churn-drill holes varying from 65 ft. to 121 ft. in depth. About the center of the face at the bottom there were drilled thirty-four 16-ft. snake holes, which were loaded and fired with the main shot, to relieve a heavy toe at that point.

The holes were spaced 16 to 17 ft. apart and had an average burden of 22 ft. Red Cross gelatin 60% and Red Cross Extra 33% dynamite were the explosives used, Nearly all the holes were double-loaded with usually a 12-ft. break. Cordeau Bickford was used in each hole to detonate the explosives.

In all there was used in well holes 7,900 lb. of Red Cross 60% gelatin, which was used for bottom loads, and 7,300 lb. of Red Cross Extra 33% dynamite. About 300 lb. of 33% Extra was used in loading the snake holes.

There was 64,000 tons of rock shot down in this blast, well broken and distributed for hand loading.

The Japan Aluminum Manufacturing Co., which has recently been floated by Tokyo, Osaka, and Nagoya capitalists with capital of 1,000,000 yen ($498,500) is building a factory at Rokuga-mura, a suburb of Nagoya. It is to be completed in the course of July, and operations are to be started in August. The management of the company intends at the start, the "Japan Chronicle" states, to turn out about 250 tons a year.

Mining Methods at Mount Lyell*

SYNOPSIS—A description of some of the unusual mining methods in use at the Mount Lyell property. Stoping methods are described, and the means of facilitating ore movements explained.

The mining methods employed in the Mount Lyell Mining and Railway Co.'s mines, Tasmania, are perhaps less known to the mining world than those of other important districts, owing to the geographical remoteness and isolation of the Mount Lyell field, but they present many features that are unusual and should be of interest to the mining engineer.

Typical mining is carried out on an open-stope system, of which the outstanding feature is that the ground is so worked as to be largely self-supporting by virtue of domical form given to the stope roofs. It is locally termed "rill" stoping, but such terms as "dome stoping" or "arched-back stoping" would be more appropriate and descriptive. The Mount Lyell pyritic body lends itself to the adoption of the system in its simplest form, and a description of stoping in this mine will serve best to illustrate it, while later reference to details of practice in the North Lyell mine will indicate how it may be varied to meet more difficult circumstances.

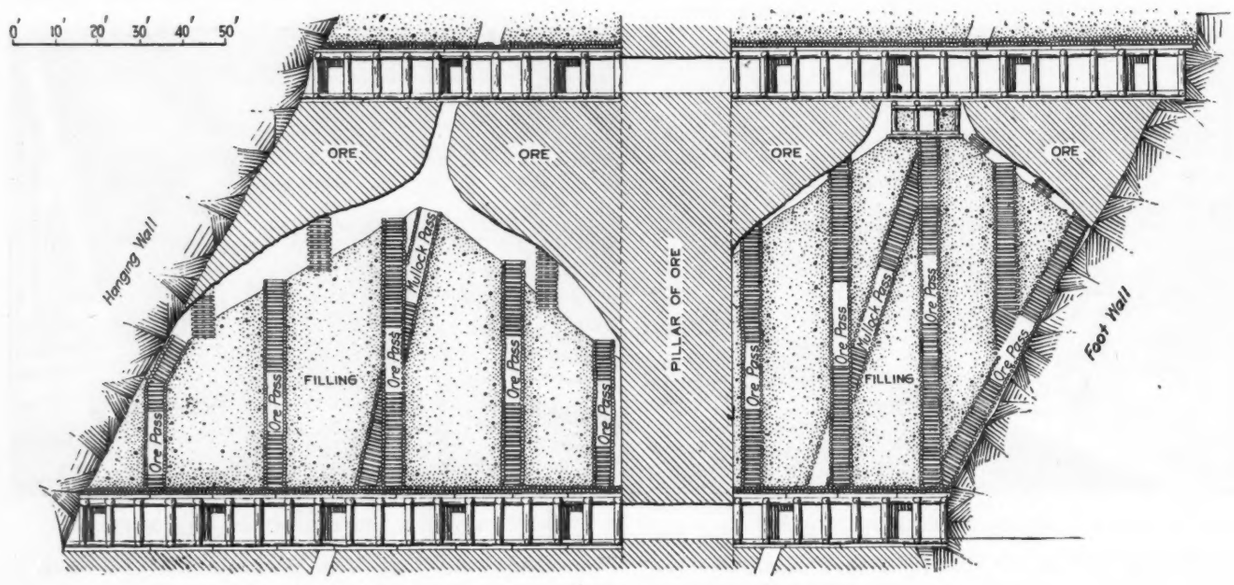


FIG. 1. STOPE ARRANGEMENT AT MT. LYELL

The Mount Lyell Ore

The orebody in the Mount Lyell mine is a huge mass of cupriferous iron pyrites, irregularly elliptical in shape in horizontal section, and with the exception of a few schist intrusions, is remarkably homogeneous and solid in character, though denser and harder on the foot wall than on the hanging-wall side. The walls are well defined, the foot wall being formed by the contact conglomerate, although that rock is almost invariably separated from the pyrites by a band of schist of varying thickness; it is strong and has a marked and regular underlay and forms an excellent "skewback" for the stope arches. The hanging wall is of the typical gray micaceous schist of the district, which flakes off fairly readily and rarely has much strength; it is irregular in underlay, varying from nearly horizontal to nearly vertical, necessitating that the stoping method adopted must provide for its being inherently weak and make special provision for the excavation of the ore below it.

The orebody has a general southwesterly underlay of 26° from the vertical between the surface and No. 7 level, and thence donwards it flattens considerably. From the outcrop down to No. 5 level, a vertical distance of 350 ft., it has been extracted almost completely by open-cutting, except in its two extreme ends. The portion below No. 5 level is being worked for a depth of 250 ft. by underground mining. Its size varies considerably at each level, chiefly because of irregularities in the hanging wall above referred to.

The conditions under which underground extraction was inaugurated presented unusual opportunities for attacking the orebody by some completely predetermined method, in that its size and shape had been already ascertained by contour drives at Nos. 5, 6 and 8 levels and were also partly known at No. 7 level, while the body itself below No. 5 level was absolutely intact. As a matter of fact, the complete scheme of working that has been carried out was designed in the office before a shot was fired in the mine, and the original design has been followed practically without any modification.

The method adopted is to cut up the body at each level into suitable stoping sections, divided by pillars of solid ore 25 ft. thick, which are continuous in vertical planes throughout the mine, there being two transverse pillars 100 ft. apart, and also two longitudinal ones 75 ft. apart, as shown in Fig. 1. These pillars develop stoping areas, which they either circumscribe entirely, or which are bounded partly by them and partly by the natural walls.

*A paper by R. M. Murray, read before the Australian Institute of Mining Engineers and published in "Proceedings," N. S., No. 19, 1915.

The area of each stope being thus outlined, sill-floor stoping in each section is commenced from some convenient point of attack and the ore beaten out for a height of about 12 ft., the back being left flat and temporarily supported by stacks where necessary; these are, however, not extensively required. Where the underlay is considerable, small isolated pillars are left under the hanging wall to provide strength in case of erratic flattening.

Traveling Ways and Mullock Passes

When the sill-floor stope has been well advanced, a rise is put up from a central position to connect with the mullock[1] pass at the level above, and the construction of the galleries, or traveling-ways, is commenced. These are laid out with special regard to the placing of ore passes adequately to serve the overhead stope, and usually comprise one main gallery leading direct to the ore-shaft, with cross galleries at right angles to it and 21 ft. apart center to center, extending to the walls or pillars, as the case may be. The galleries are constructed of strong square-set timber, forming cubical cells 7 ft. center to center, and 8 ft. 6 in. high, the legs being specially large—often from 2 ft. to 2 ft. 6 in. in diameter—in order to provide good seating for the caps and struts and afford stability against the flow of mullock during the initial filling operations. The sills of these sets are laid down on heavy round lagging 15 ft. long and 8 to 10 in. in diameter, to facilitate picking up the level subsequently. The legs are temporarily stayed in position by raking props. The sets are covered over on top with a double layer of heavy round lagging laid transversely on stringers placed longitudinally along the struts. The floors of the panels formed between the cross galleries are also covered with heavy round lagging, laid breaking joint, and the portion of the stope around the central mullock rise is then ready to receive filling.

To facilitate this the bottom of the rise is given a wide bellmouth when commenced, so that when filling is first passed down, it can be spread over a considerable area. The sides and tops of galleries having been lined with old coke bags to prevent fine material escaping through them, mullock is run in and allowed to fill as much of the nearest panels as possible and so support and cover the adjoining gallery timbers, and everything is then in readiness for the first overhead stope to be commenced. This is undertaken from the rise, working outward and downward in all directions, enlarging the original bell-mouth into a small domical chamber. Mullock is then again run in, covering further portions of the sill floors and timbers and forming a cone below the rise from which to begin further breaking operations. When several small stopes have been taken off in this manner, a fairly large dome-shaped chamber containing a corresponding cone of filling has been formed, and the stope is then well opened up for vigorous ore-breaking, the domed roof eventually covering the whole of the sill-floor area and having for its abutments the pillars or foot wall, as shown in the illustration in which the development of several stopes is indicated by means of contours.

The multiplicity and placing of ore-passes is a special feature of the system, and their construction is taken in hand immediately prior to each mullocking. They are built of 10-in. round or split timber joggled at ends, their size being 6x4 ft. They are placed on each side of the galleries at such distances that their centers are about 15 ft. apart horizontally, the close spacing reducing the handling of the ore in the stope to a minimum, and also rendering the wear on the timbers very much less than would be the case were all the ore broken handled into fewer passes. As the height of the stope increases, however, and the slope of the filling becomes greater, the ore can be conveniently handled over greater distances, and some of the passes are then discarded, being allowed to fill completely with mullock. The ones discarded are naturally those situated toward the central portion of the stope, those on the periphery being rigidly maintained, although it is an essential feature of the system that the ore is not made to gravitate to the bottom of the slopes, as is generally the case with "rill" systems, but can be readily shoveled or raked direct into a pass, whatever its position in the stope may be.

Prior to each mullocking each pass is built up to the back, against which it is wedged for support, and the logs are further held in position by vertical timbers placed against the sides and ends, those on the downhill side being strutted with raking props to withstand the force of the mullock as it is being run in. As in the case of the galleries, the outsides of the passes are lined with old bags to prevent the passage of fine material between the logs. Passes contiguous to pillars and over the central portion of stope are kept vertical, and those adjacent to walls are pulled over to conform to the underlay of same, except in cases where the hanging wall is very flat, when they are discarded. The vertical ones do not require inside lining, but where there is any considerable underlay the lower side and ends are sheathed with 8x2-in. planking to prevent the wearing away of the logs. Immediately below the mullock rise a special pass is constructed for transferring mullock to the level below. This is sheathed with 8x2-in. planking, and has a manway partitioned off. Manways, 3x3 ft., are also built in each corner of the stope. Where necessary, individual passes are built up to the back as stoping proceeds, to serve temporarily as stacks for supporting weak or heavy portions of back. All timber used for pass-building is thrown down the mullock rise from the level above, reducing the handling cost to a minimum.

Methods of Stope Filling

Mullock for filling purposes is obtained from the open-cut, where it is broken in the ordinary course of overburden removal, and if not utilized in this way, would be tipped to spoil, as was the case prior to the commencement of underground mining. It is delivered direct from wagons into each of the passes leading to the stopes as required, water being simultaneously led into the pass, so that when it reaches its destination, it has a consistency similar to that of wet concrete. The flow of mullock is controlled by a chute door at the level immediately above the stope to which it is proceeding. Under favorable conditions—that is to say, after a stope has been well opened up and the requisite slope of back attained—about 75% of the mullock required to fill it will run into position by gravity alone, the only labor expended being that of one and sometimes two men per shift controlling the overhead chute and into some of the larger stopes a quantity of 5,000 yd. (broken) is sometimes delivered at one filling. When the stage is reached that the mullock ceases

[1]Mullock.—Country rock or waste.

to distribute itself by gravity, a gang of mullockers proceeds with the work of leading it to the remote corners, which is effected by laying timber slides of 8x2-in. planks from the pass to the place to be filled. The wet mullock travels readily along these slides, even when laid with very slight inclination, with but little assistance from men stationed with shovels at intervals along their length. Over the central portion of stope the filling is allowed to reach to within a foot or two of the back, leaving sufficient space to permit of the next layer of ore to be shot down and fall freely. Under the hanging walls and near the pillars it is allowed to run right to the back, and so afford direct support. The character of the filling is such that, when mixed with water, it soons sets very hard, requiring picking to break it, and it subsides very little after being put in. In fact, in cases where it has been necessary to make excavations in it, it has been found to stand readily with high vertical and even overhanging faces. For this reason it has been considered unnecessary to place lagging against the pillars, as no difficulty is anticipated due to "running" when these are being extracted. When mullocking is nearing completion fine material only is run in in order to fill up the interstices between the large fragments and so form an even surface upon which to break down the ore. This surface can be readily scraped down when the stope is being cleaned up prior to the next mullocking, thus insuring that none of the broken ore is lost.

When breaking and mullocking operations are carried out alternately, as already described, all production from the stope necessarily ceases during the latter operation, and this, in the case of large stopes, means considerable interference with the total mine output. This interruption, however, can be overcome by so working the stope that only half of it is beaten out at a time, then erecting at the rise a barricade which will direct the filling to the depleted portion while the second half of the stope is being worked, and this is now the ruling practice in the larger stopes of the mine.

Reaching the Overhead Level

The highest portion of the stope being always at the mullock rise, it is here that the overhead level is first reached. The method of "picking up" is to flatten off the apex of the cone of filling at a convenient height for one set of timber—usually about 6 ft. below the overhead lagging—and so form a base on which to erect the 5x5-ft. picking-up sets. The leveled-off area is covered with heavy round lagging, which serves to spread the pressure, and on this the sill timbers of the sets are laid. The filling forms a firm and almost unyielding foundation, being even more than ordinarily consolidated in this locality, due to the ramming action of the mullock during the running of the pass. When the sills have been laid immediately below and around the rise the collar of latter is broken away, and the overhead lagging caught up on square sets erected on the sills, and securely packed and wedged up, stringers being used on top of the sets where necessary. As each succeeding stope is taken off, the picked-up area is increased by the addition of one or more rows of sets around those already in position, each successive mullocking increasing the area of the flat base on which they are erected.

By means of timber slides the mullock required for the lower portions of the stope can be directed from the chute at the overhead level through the picking-up sets to the summit of the rill and will flow in this way, by gravity alone, over a radius of 20 ft. (horizontal) round the pass in every direction. When the picked-up area extends beyond this limit the flow needs to be assisted on the slides by a certain amount of shoveling, and the filling is handled in this manner until a radius of 30 ft. from the pass has been attained, it being only the portion of the stope beyond this limit that requires its filling to be transported by trucking. As the picking-up sets are stood as many as possible are packed tight with filling, only those required to form passageways for the mullock slides being left open. The ore-face round the timber is always kept steep, being the upper limit of the sloping sides of the stope, and this insures that there are no thin plates or crusts forming the roof of stope and floor of overhead level, and consequently no weakness or danger of collapse of the latter on this account. The portion of the level picked up in this manner gradually subsides to a small extent, the subsidence, however, rarely exceeding more than about 12 in., and is always uniform, very little disturbance of the level timbering being noticeable.

The Cost of Stoping

In the general work of ore-breaking 3-in. piston machine drills are used, each being operated by one man, and two machines working in close proximity, so that the drillmen can assist each other in lifting, etc., the shovelers being also available for this purpose. Commencing at the rise, and working outward and downward, the holes drilled are roughly parallel to the slope of the filling and are all consequently down or "water" holes, which conduces to leaving a clean back and also minimizes dust. A water-jet is used with each machine. The ore usually breaks big, and is reduced to a convenient size for spalling by "popping" with hammer drills, and sometimes by "blistering." When approaching any flat hanging wall the work is planned as far as possible to cause the ore to settle on the filling in large masses, when it can be worked out in safety, thus avoiding the necessity of working under "shells" of ore too thin to be self-supporting. The layer of ore taken out in each "break" is usually 8 ft. thick, measured normally to the slope of the filling, and is generally taken out actually in two layers, the machines going over the whole of the back twice. In any place where the roof appears to need special support stacks are erected, but they are rarely required, and ore-passes are frequently built up to the back as substitutes.

The leading features of the system are shown in the figure, which is a vertical section through two adjoining stopes, one on the foot-wall side and the other on the hanging-wall side of the orebody, separated by a pillar. The section as drawn is based upon an actual working section, but certain modifications have been made to fully illustrate various details already described. The hanging-wall stope is shown as it would appear just after ore-breaking has been finished over its entire area, the stope being ready for pass building and for the running in of filling. The foot-wall stope is shown as it would appear immediately after filling operations have been completed, and when ore-breaking is about to be recommenced. The central portion of this stope is shown picking up the overhead level. In each stope the mullock-pass is shown logged up through the filling, and its continuation to further levels above and below the stope is indicated.

The principal advantages claimed for the method are:

1. Strength of the stope roofs, due to their domical form and to the avoidance of opening up any great area of any horizontal layer, or head.

2. Economy in handling ore in the stope.

3. Economy in filling stope.

4. Economy of timber for support, the few stacks required for this purpose being almost invariably recovered.

5. Accessibility of all portions of the back for inspection, barring, etc., any part being easily reached horizontally from some point on the filling.

6. The general advantages arising from the boring of all down holes, as well as the important one of minimizing dust.

To justify these claims some statements may be made. The average amount of ore broken per machine per shift is 25 tons, and the amount moved per man per shift is 25 tons. As much as 100 tons has been handled by one man under favorable circumstances. The amount of ore recovered per man per shift is 10½ tons. Working costs in a typical stope are shown in the table.

COST OF STOPING AT MT. LYELL

	Per Ton, Dry s.	d.
Drilling, spalling and handling	1	9
Timbering	0	3
Mullocking	0	3
Trucking	0	4½
Winding	0	2½
Steel sharpening	0	1
Explosives	0	3
Stores	0	6
Timber	0	5
Power	0	3
Miscellaneous	0	10
Supervision	0	5
Total cost, delivered into service bin	5	3

Military and Mining Life

Life in the military encampment of the National Guard on the Mexican border is a strenuous one, but as a letter to the *Journal* from one of the officers points out, it embodies so many features for which life in the mining camps has been a good preparation that some interest may attach to a general outline of the details. The following quotations from the letter give an idea of the work that is being done:

"At 5 a.m. first call sounds, and with the last notes of the bugle the band starts playing for five minutes, and then reveille sounds and the day is begun. The recall from the last drill is 7:45 p.m., which makes the day very much like many I have put in in mining. Besides various drills and duties, there is school twice a day, one for the 'non-coms' and one for officers. From 11:30 a.m. to 3 p.m. it is so beastly hot that we emulate the natives and have *siesta*.

"The water is alkali, flat and warm, and absolutely fails to quench thirst. Butter is not a part of army rations and for some unaccountable reason is not missed. The newspaper yarns about the experiences of the National Guard are sickening to one who is in and knows; and while things are far from being beyond criticism, most of the criticism published is utterly yellow.

"My mining experience has been so much on the frontier that this kind of life finds me adaptable, and I'm quite comfortable (which some are not), except for the seven hundred million different kinds of bugs which infest the earth and air here. Much of my mining gear fits well into this life. My old 'war bag,' such as every mining engineer carries, is with me and so is my usual canvas bedding roll, which I prefer to the army bedding roll. My mining bedding has given way to olive-drab army blankets; otherwise my bedding roll is the same I have dragged over many a mountain trail. A compass is part of a military engineer's prescribed equipment, and that is where my Brunton comes in. When I first got into camp, we had no lights, so I made a 'San Pedro' lantern of a tomato can and a candle, such as every old sourdough in the desert uses, but it was a novelty in this outfit and I had a lot of fun with it. Of course, I promptly sent for some of John Simmons' carbide mining lamps, such as I have used underground, and am writing by one now, hooked into an angle in my tent fly. I am sitting in a very comfortable chair I made myself, patterned after many I have seen in prospectors' shacks. It is the only chair with a back in this outfit, except those purchased, which have folding backs; and inasmuch as we are limited to 50 lb. of impedimenta, some of the high-toned chairs are going by the wayside on some of our moves.

"This concentration camp is rapidly growing into a cantonment with many semi-permanent features as to buildings, cook and men's shacks, water-supply and shower baths."

Greatest Petroleum Production

That 1915 was the most successful year of production in the history of the petroleum industry is shown by statistics just compiled under the supervision of J. D. Northrop, of the United States Geological Survey.

The total quantity of crude petroleum entering the world's markets in 1915, which amounted to 426,892,673 bbl., exceeds the former record, established in 1914, by 28,194,307 bbl., or 7%.

The bulk of the increase in 1915 came from the United States and Mexico, though Russia, Argentina and Japan recorded significant gains.

The distribution of this production is shown in the following table:

WORLD'S PRODUCTION OF CRUDE PETROLEUM IN 1915 AND TOTAL YIELD SINCE 1857

Country	Quantity, 1915 — Barrels of 42 Gal.	Metric Tons	% of Total	Quantity, 1857-1915 — Barrels of 42 Gal.	Metric Tons	% of Total
United States	*281,104,104	37,480,547	65.85	*3,616,561,244	482,208,266	60.10
Russia	68,548,062	9,353,077	16.06	1,690,781,907	222,984,256	28.10
Mexico	32,910,508	4,388,068	7.71	123,270,377	16,420,008	2.05
Dutch East Indies†	12,386,808	1,710,445	2.90	148,999,921	20,087,939	2.48
Roumania	12,029,913	1,673,145	2.82	130,012,387	17,477,878	2.16
India	‡7,400,000	986,667	1.73	80,789,711	10,771,961	1.34
Galicia	4,158,899	578,388	0.98	136,032,500	18,918,364	2.26
Japan and Formosa	3,118,464	415,785	0.73	30,169,622	4,022,606	0.50
Peru	2,487,251	331,633	0.58	16,794,223	2,239,229	0.28
Germany	995,764	‡140,000	0.23	13,961,333	1,875,974	0.23
Trinidad	‡750,000	100,000	0.18	2,819,430	375,924	0.05
Argentina	516,120	75,900	0.12	1,033,121	151,693	0.02
Egypt	221,768	29,569	0.05	1,308,496	174,466	0.02
Canada	215,464	28,729	0.05	23,709,074	3,161,210	0.39
Italy	39,548	‡5,500	0.01	842,020	119,279	0.01
Other	‡10,000	1,333		372,000	49,600	0.01
Total	426,892,673	57,298,786	100.00	6,017,457,366	801,038,653	100.00

* Marketed production. † Includes British Borneo. ‡ Estimated.

Increased Quicksilver Development brought about by favorable markets has caused great activity in search of new quicksilver prospects, according to U. S. Geological Survey, and discoveries near Morton, Wash., and Beagle, Ore., in 1916, have led to some development and construction of reduction plants. Also in the Skull Valley deposits, Ariz., referred to many years ago by W. P. Blake, and at Black Pine, Idaho, some activity is reported. Many old furnaces have been repaired or enlarged in California, Nevada and Texas, old workings have been reopened, and new discoveries have been developed.

A Source of Flotative Agents*

SYNOPSIS—Since so many kinds of oils have proved available for use in flotation concentration, efforts are being made to extract them from vegetation native to the country where the process is practiced. This has been done in Australia, resulting in the use of the native eucalyptus oils.

The reagents now used in flotation consist of various acids or salts, which may be either electrolytes or non-electrolytes, dissolved in water and some substance or combination of substances that function as collecting or frothing agents. At times the only dissolved salts present are those naturally occurring in the water used. The general effect of the electrolyte is to sharpen greatly the separation between the gangue, and the concentrate. Examples of this are the use of sulphuric acid with zinc ores and of sodium carbonate or calcium oxide (lime) with silver-gold ores. Crude pyroligneous acid is sometimes used when available. Various oxidizing agents, such as permanganates, bichromates, etc., are added in the selective flotation of lead-zinc ores. Many others, reagents for performing certain specific functions, either real or imaginary, have been proposed, and many of them have been tried upon a working scale. The wild orgy of experimentation that is now going on in flotation even exceeds that in evidence shortly after the introduction of the Washoe process for the treatment of Comstock ores when, among other things, sagebrush tea and tobacco juice were in evidence as reagents added to the pans. Out of all this will eventually come a more or less standard practice for the treatment of each class of ore.

Omitting a discussion of the functions of frothing and collecting agents, the reagents used in flotation for this purpose may be classified under five general heads: Essential oils; fixed or fatty oils; alcohols and their combinations with organic acids; coal tar and its refined products; and petroleum and its refined products.

The term "oil" in flotation parlance, as usually applied to this class of reagents, is a loose and inaccurate one. The word "oil" appears to be derived from the Greek word *elair* (meaning the olive tree) through the Latin *oleum* and the French *huile*. By the ancients it was applied to all liquids having an oily nature; for example, sulphuric acid was called oil of vitriol. When the term oil is applied, even to any one of the general classes of frothing and collecting agents, many inconsistencies are bound to arise; as, for example, acetic acid, the lowest member of the series of fatty acids, cannot in any sense be considered an oil, while the next member in the series, oleic acid, has a distinctly oily nature. Crude coal tar can scarcely be called an oil, although certain of the fractions from the redistillation of tar have a distinctly oily nature. Again, certain of the refined products of coal tar that have proven to be valuable flotative agents, such as carbolic acid, cresol, etc., are not of an oily nature. Then there are the alcohols, particularly the higher members of the series, such as amyl alcohol (fusel oil), which in some cases appears to be able to perform the dual duty of both frothing and collecting agent as efficiently as certain of the essential oils. It is, however, interesting that as you go higher in the alcohol series, they acquire a distinctly oily nature. The term "oil" has apparently been used for the lack of a better one. It would seem that the general term "flotative agents" could be applied to those substances added to function as frothing or collecting agents, while "modifying agents" could be applied to the various other reagents that are added.

A flotative agent of some kind is required in flotation as now practiced. A single reagent may perform the function of frothing and collecting agent, or a mixture of substances may be required.

In this country the essential oils used have been wood products and have been almost exclusively confined to the steam-distilled pine oils. At present the supply of these is limited and the cost almost prohibitive, so that their use has been dispensed with as far as possible.

The oils and tars resulting from the destructive distillation of the various species of the *coniferae* find a more general use on account of the greater supply and lower cost, although even these have risen in price and the future supply is somewhat problematical if the demand for them in flotation continues to increase at the same rate as in the past. The fixed or fatty oils, with the exception of oleic acid and crude pyroligneous acid and crude pyroligneous acid, are scarcely ever used, since they in general give poor results as compared with other flotative agents. Coal tar is a common and cheap product, but not all coal tars are suitable for use in flotation, and furthermore, the marketing of coal tar is coming more and more into the hands of large distributors who contract for the output of the various gas plants. The refined products of coal tar are useful flotative agents, but in the case of certain of these, as for example, carbolic acid and cresol, the price at present is prohibitive. In general, crude coal tar yields the best results when mixed with other oils. It is a frequent practice to use a small proportion of pine oil in order to modify the froth. In many cases these cheaper mixtures yield satisfactory results and can now be obtained at a reasonable cost.

MARK TWAIN AND THE SAGE BRUSH
From first edition of Mark Twain's "Roughing It"

It appears that only the crude petroleum oils having an asphaltic base are in general useful in flotation. These are invariably mixed with other oils. The refined products of petroleum are generally not satisfactory, except as constituents of oil mixtures. The one exception to this is perhaps the case of kerosene-acid sludge, which is a byproduct of petroleum refining. Kerosene acid sludge from Eastern refineries gave unsatisfactory results at Anaconda, but the California product resulting from the refining of crude oils having an asphaltic base is satis-

*A paper by G. H. Clevenger, associate professor of metallurgy, Leland Stanford Jr. University, Palo Alto, Calif., in the "Bulletin of the A. I. M. E.," September, 1916. This article contains, however, material supplied by Professor Clevenger that did not appear in the A. I. M. E. publication.

factorily used in conjunction with a small proportion of wood creosote for the treatment of Anaconda copper ores. While California kerosene-acid sludge is, with many ores, a satisfactory flotative agent, the supply available tends to limit its use. Formerly it was a drug on the market and California refiners threw it away, but now little of it is available upon the open market, since practically the whole of the present production is contracted for a long time in advance by pioneer users.

Flotation Oils from Vegetable Sources

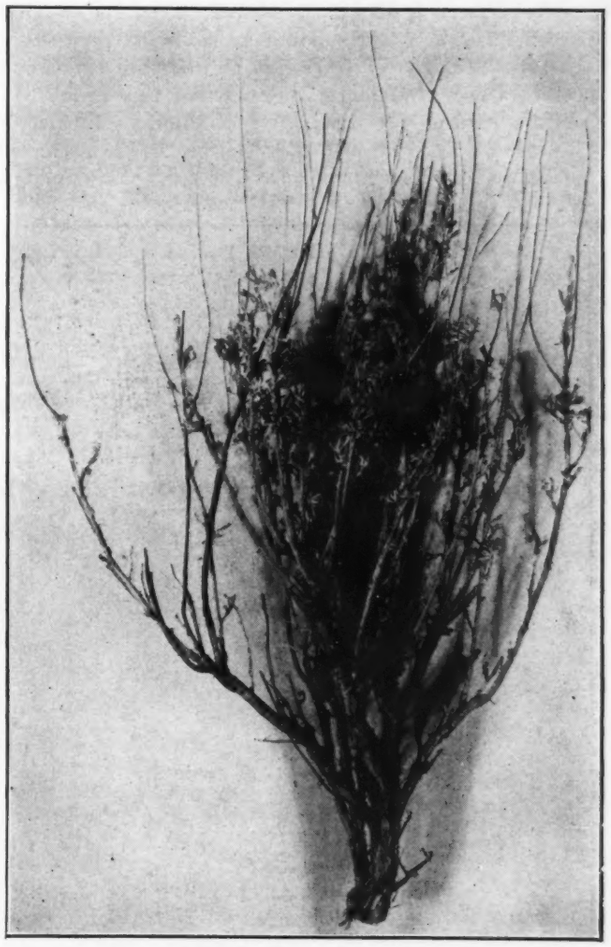
The matter of suitable oil supply, both as regards the character of oil to give the best results and its present and future availability, is a matter of serious consequence to companies operating flotation plants. It was with this in mind that I began the investigation of other possible sources of flotative agents, with the particular object of affording relief to mines in the arid regions of the West where none of the common flotative agents are locally available and where transportation costs upon those from the outside are high.

Certain plants and shrubs have the peculiar property of secreting oil during the growing season in the new growth, and particularly in the leaves. Botanists appear to be uncertain regarding the function of this oil in the metabolism of the plant. Some hold that it is a reserve food supply for the plant, while others state that it is waste product which the plant fails to throw off. Be this as it may, many plants, shrubs and trees contain oil in the leaves and new growth. A good example of this is the case of the eucalyptus tree, from the leaves of which are recovered by steam distillation essentials oils which are used for various purposes. The leaves of the variety known as *amygdalina,* unique as being the tallest tree in the world, have afforded a large proportion of the flotative agent used in the concentration of complex Australian ores. This variety of tree is, fortunately, plentiful in close proximity to these ore deposits.

Sage Brush a Source of Oil

In the great arid and semi-arid mining regions of the West, in seeking a similar source of flotative agents one is limited to a consideration of the few plants and shrubs native to the region. The most common of these, as even the casual traveler from the East can testify, are the various varieties of sage brush commonly known as mountain sage, pasture sage, wormwood sage, etc.; also, in certain regions, greasewood and other shrubs of a similar nature. It is therefore to the Sage Brush State—Nevada—and to the much-despised sage brush, that my attention has been directed in the search for flotative agents for concentrating Western ores. I need not describe sage brush, for Mark Twain[1] did this vividly years ago.

It appears that the several varieties of wild sage were first investigated by certain members of the Department of Agriculture, with regard to the possibility of producing from them by steam distillation essentials suitable for pharmaceutical use. Steam-distilled oil was prepared by Rabak[2] from the variety *artemisia frigida* in 1905, and during the summers of 1907 and 1908 larger quantities of oil were prepared from specimens of the plant collected in South Dakota. In 1912 an essential oil prepared by the steam distillation of *Ramona stachyoides* (black sage) from southern California was also reported by Rabak. This oil was said to contain 40% of champhor. In 1914 Charles E. Burke and Charles C. Scalione[3] gave an account of an investigation of an essential oil that had been prepared from the same shrub by the steam distillation of several hundred pounds of leaves and twigs collected from brush growing near Riverside, Calif. The yield of oil in this case was 0.9% of the weight of the material used. This yield was somewhat higher than that reported by the Department of Agriculture. This



ARTEMISIA TRIDENTATE

is perhaps accounted for by the fact that the brush was collected later in the season. This oil is reported as having the following composition:

COMPOSITION OF BRUSH OIL

	%		%
Pinene	6	Thujone	8
Cineol	30	Camphor	25
Dipentine, terpinene, etc.	25	Resinous material	5

Camphor was separated from a portion of the oil, thus demonstrating the rather interesting possibility of black sage as a source of borneol camphor. Upon request, Mr. Scalione supplied me with a small sample of the original oil. This is clear, with but a slight yellowish tinge, and has an agreeable odor. In fact, so far as appearance and general behavior goes, although the chemical composition is somewhat different, it very much

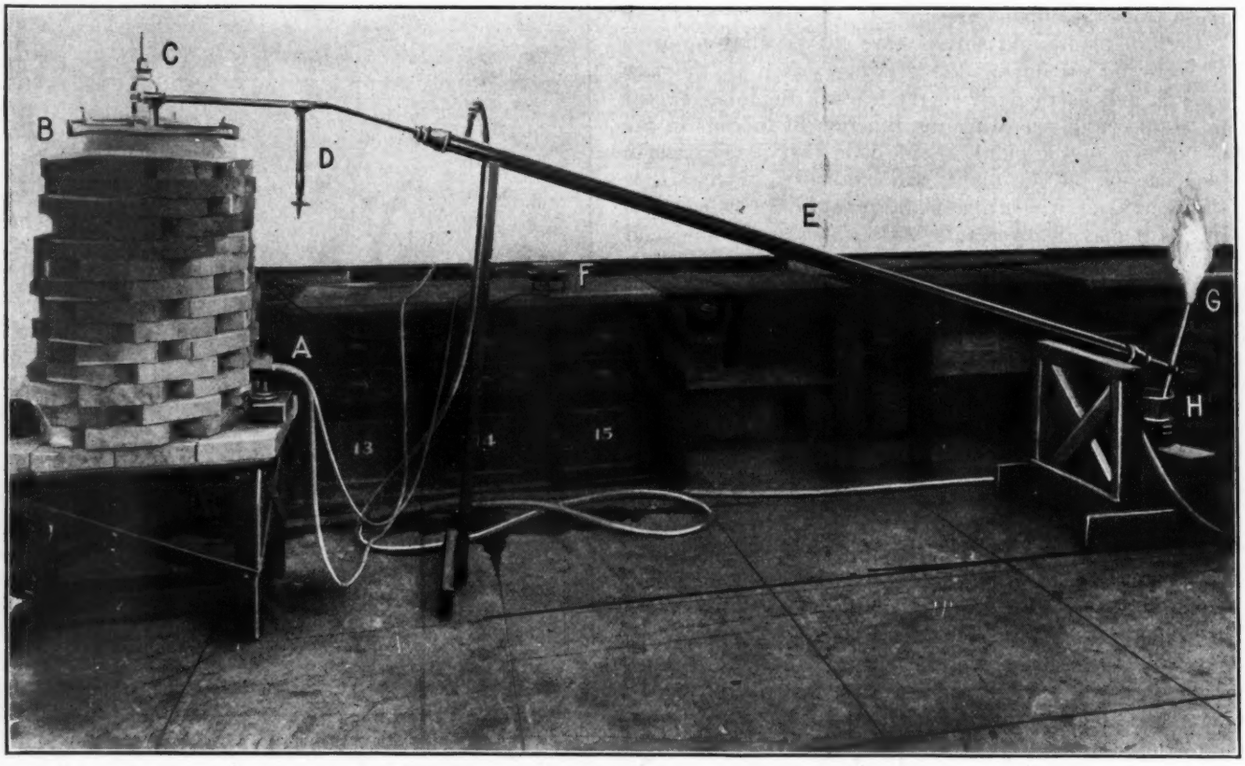
[1] "Roughing It," Mark Twain; First Edition, p. 33.

[2] "Wild Volatile-Oil Plants and Their Economic Importance," Frank Rabak; Bureau of Plant Industry, Bulletin 235, p. 22.

[3] "Investigations on Oil of Black Sage," Charles E. Burke and Charles C. Scalione; "Journ. Indus. and Eng. Chem.," Vol. 6, pp. 804, 806.

resembles steam-distilled eucalyptus oil from the Australian amygdalina. This oil is a good frothing agent, and although the amount available did not permit of thorough investigation, it yielded quite satisfactory results upon lead and zinc ores in a qualitative way. Although the idea of investigating sage brush and greasewood as possible sources of flotative agents was conceived early in January, it was not until early in March that the first 100 lb. of sage brush was forwarded to me through the courtesy of G. B. Lantz. This lot was collected near Goldfield, Nev., and upon examination proved to be the variety *artemisia tridentata*. "In the Western Arid Transition zone the flora consists largely of the true sage brush, *artemisia tridentata*,"[4] therefore this would be the variety available to the mines of this region.

An apparatus for destructive distillation, capable of treating 30 lb. of brush at a charge, was constructed, and two charges of the brush distilled. The products



APPARATUS FOR DISTILLING OILS FROM SAGE BRUSH

that came over first consisted of acid liquor resembling the crude pyroligneous acid obtained from wood distillation, a black oil or tar, and inflammable gas. Finally these products ceased to come over, but upon raising the temperature a considerable amount of gas was given off and a rather thick reddish-brown liquor having an alkaline reaction began to come over, and with it was a small amount of tar similar to that which came over with the acid liquor. The brown liquor had the characteristic fishy odor peculiar to the mines. There was also at times a distinct ammonical odor. The acid and alkaline liquors were kept separate, while the tar from both was combined. These three products were first tried qualitatively in the flotation of finely ground samples of various minerals such as galena, cinnabar, pyrite, etc.

[4] "Encyclopædia Britannica," Eleventh Edition, Vol. 27, p. 634.

The acid liquor behaved much as ordinary pyroligneous acid. The alkaline liquor was a good frothing agent, although the froth carried up but little mineral. The tar that came over with the acid liquor proved to be a splendid flotative agent.

Testing Sage Oils on Various Ores

Following this, quantitative tests were made upon a number of different ores, employing the tar produced from this lot of sage as a flotative agent. These results, a number of which are given, were in general very satisfactory.

A sample of zinc ore from the Butte & Superior mine, Butte, Mont., containing 22.39% of zinc, gave, when tested in a Janney laboratory machine employing a solution of 0.25% of sulphuric acid, 97% extraction of the zinc. The first concentrate contained 53.8% of zinc, the second 48.9%, the third 40.5% and the fourth 18.1%. The oil consumption was at the rate of 0.4 lb. per ton of ore.

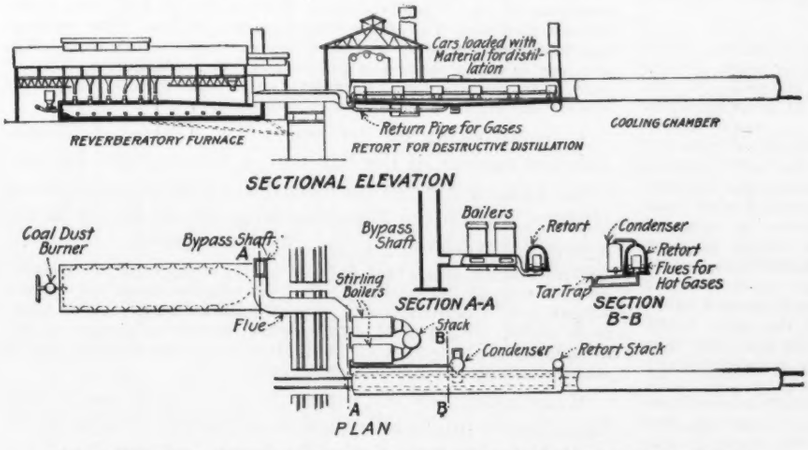
A sample of mercury ore from the New Almaden mine, California, containing 0.26% of mercury, gave, when tested in a Janney machine employing a 0.2% solution of sodium carbonate, an extraction of 90% of the mercury. The first concentrate contained 3.6% of mercury, the second 2.5%, the third 1.55% and the fourth 0.95%. The oil consumption was at the rate of 1 lb. per ton of ore.

A sample of lead ore from the Cœur d'Alene region, containing 12% of lead, gave, when tested in a Janney machine employing a 0.05% solution of sodium carbonate, an extraction of 92.2% of the lead. The calculated lead content of the total concentrate was 37.3%. The oil consumption was at the rate of 0.67 lb. per ton of ore.

A sample of silver-gold ore from the Ophir mine, Virginia City, Nev., assaying 0.46 oz. gold and 7.4 oz. silver per ton, gave, when tested in a Janney machine employing a 0.1% lime or sodium carbonate solution, an extraction of approximately 90% of the silver and 95% of the gold. The first concentrate assayed gold 5.3 oz. and silver 198 oz. per ton; the second, gold 3.75 oz. and silver 72.9 oz. per ton; and the third, gold 1.32 oz. and silver 35.3 oz. per ton.

The oil consumption when employing sage tar appears to be less than with most of the other oils experimented with in treating the same ores, and furthermore, the extraction was in general better. Since it is general experience that large-scale operation requires less oil than is indicated by small-scale tests, it is reasonable to suppose that the oil consumption in treating the ores cited would be materially lessened when working upon an operating scale, and likewise, possibly the extraction could be bettered. This latter I think is particularly true of the Ophir ore.

Later in March another lot of brush was collected by Mr. Lantz from the same locality. This proved to be the same variety, but more fully in leaf than that collected earlier in the season. Distillations were run on this lot, keeping the various products separate, so that they could be properly measured and weighed.



DESTRUCTIVE DISTILLATION PLANT OPERATED IN CONNECTION WITH REVERBERATORY FURNACE

Distillation of Sage Brush

Temperature measurements were made at regular intervals by means of a thermocouple, and as a result there was better control of the heating than in former tests. The yield from the last of these tests, which was the most carefully conducted and was therefore perhaps the most representative, was as follows:

YIELD OF SAGE-BRUSH DISTILLATION

	Lb.	%
Weight of sage brush used	30	
Acid liquor	8.4	28.00
Tar with acid liquor	1.1	3.66
Alkaline liquor	0.66	2.20
Tar with alkaline liquor	0.09	0.30
Charcoal	10	33.33
Gas (by difference)	9.7	32.51

The retort was slowly heated for one hour before liquid began to condense. The temperature at the end of this time at the center of the charge as indicated by the thermocouple was 60° C.; the temperature at the sides of the charge was probably somewhat higher. In the next period of six hours, during which the acid liquor and most of the tar came over, the temperature rose from 60° to 275°; the rise above 100° taking place during the last hour and a half. The alkaline liquor and the last of the tar came over in the last period of three hours, during which the temperature rose from 275° to 611°.

It is reasonable to assume that a yield of about 4% of the tar oil can be realized if the sage is collected at the proper season and the distillation carried on by the best methods. Then there is the acid liquor, which in certain cases could be used directly in flotation, or it might prove profitable to recover the alcohol, acetic acid, the dissolved tar oil, etc., which it contains. I have not had an opportunity to thoronghly investigate the alkaline liquor, but it would seem to present many interesting possibilities. Among other things the first lot was found to contain 2.09% and the second lot 2.16% of nitrogen. I suspect that this liquor may also contain phenolic bodies that would be useful in flotation when separated from the other constituents. The charcoal is fine, but it should be possible to utilize it for fuel in heating the retorts. One peculiarity is the high percentage of ash that it contains (10.5% in the one sample analyzed). This may be in part due to dust upon the sage brush, although it was chopped fine before distillation and it would seem that a good deal of the dust would be shaken from it during this operation. If the charcoal were burned, as previously suggested, the alkaline ash might serve instead of lime or sodium carbonate in cases where flotation in alkaline solution was practiced. The inflammable gas would of course be burned under the retorts. The proportion of the heat necessary for carrying on the operation that could be realized in this way is problematical; however, it is reasonable to assume that a considerable part of that required for destructive distillation could be produced by burning the gas and charcoal. Moreover, another interesting possibility in connection with the heating of the retorts is the utilization of the waste heat from various metallurgical operations. Fig. 4 is a sketch of a general arrangement for utilizing a portion of the waste heat from a reverberatory copper-smelting furnace, for heating a retort similar to the modern concrete retorts used in the destructive distillation of wood. It would also seem feasible in certain cases to utilize the waste heat from roasting furnaces for the same purpose.

Through the courtesy of Charles Scalione, several ounces of steam-distilled essential oil was prepared from the tip ends of a portion of the last lot of sage brush. Approximately one hour was required for distilling each charge of 20 lb. The yield amounted to 0.43% of the whole plant. This oil had a greenish-yellow color when first distilled, but became yellow upon standing. It has the characteristic penetrating odor of sage, and a decided tendency to creep up the sides of the glass containing vessel. This oil appears to have distinctly different properties from the essential oil resulting from the steam distillation of the black sage. It gives quite promising results with some ores, but in my opinion it is not nearly so good as the tar oil resulting from the destructive

distillation of the same shrub. In fact, under ordinary circumstances, I do not think that the steam-distilled oil can be given series consideration, since the mines that would be most benefited are generally located where fuel is high, and furthermore, the yield of oil is rather small, probably less than 1%. In addition, there are no other valuable products, unless the tannin extract resulting during steam distillation should have a market value or a demand should arise for "sage tea."[5]

Time has not been available for making analyses and a study of all the products resulting from the destructive distillation of sage. However, sufficient work has been done to at least show that the light tar is a very efficient flotative agent for a considerable number of ores, as indicated by the tests previously cited.

History of Sage Brush in Metallurgy

The idea of utilizing sage brush in metallurgy is by no means new, as is shown by the following quotation from the writings of Dan De Quille,[6] co-editor with Mark Twain of the *Virginia City Enterprise*. This will also serve to throw light upon the early development of the Washoe process and the wild riot of experimentation accompanying it.

> The early millmen knew but little about working silver ores, and all manner of experiments were tried with a view to the thorough amalgamation of the silver contained in the rock that was crushed. This, in the opinion of most superintendents of mills, was to be accomplished by the use of chemicals. A more promiscuous collection of strange drugs and vegetable decoctions never before was used for any purpose. The amalgamating pans in the mills surpassed the caldron of Macbeth's witches in the variety and villainousness of their contents. Not content with bluestone (sulphate of copper), salt and one or two other simple articles of known efficacy, they poured into their pans all manner of acids; dumped in potash, borax, saltpeter, alum and all else that could be found at the drug stores, then went to the hills and started in on the vegetable kingdom. They peeled bark off the cedar trees, boiled it down till they had obtained a strong tea, and then poured it into the pans where it would have an opportunity of attacking the silver stubbornly remaining in the rocky parts of the ore. The native sage brush, which everywhere covered the hills, being the bitterest, most unsavory and nauseating shrub to be found in any part of the world, it was not long before a genius in charge of a mill conceived the idea of making a tea of this and putting it into his pans. Soon the wonders performed by the "sage-brush process," as it was called, were being heralded through the land. The superintendent of every mill had his secret process of working the silver ore. Often, when it was supposed that one of the superintendents had made a grand discovery, the workmen of the mill were bribed to make known the secret. To guard as much as possible against this, the superintendent generally had a private room in which he made his vile compounds. "Process-peddlers," with little vials of chemicals in their vest pockets, went from mill to mill to show what they could do and would do, provided they received from $5,000 to $20,000 for their secret. The object with many inventors of "processes" appeared to be to physic the silver out of the rock, or at least to make it so sick that it would be obliged to loose its hold upon its matrix and come out and be caught by the quicksilver lying in wait for it in the bottom of the pans. Had it been in the dark ages that these experiments were in progress, the efficacy of the blood of human victims would doubtless have been tried: they would occasionally have hoisted an honest miner up from the subterranean depths and cut his throat over a pan. The "process peddlers" finally became a worse nuisance than ever lightning-rod men have been—the limited space of country to which they were confined being considered—and the millmen became disgusted with all the patent processes—their own as well as those of others—and soon little save salt and bluestone was used in the pans. It was found that thorough grinding and careful working of the ore was what was required.

[5]Patents are pending covering the use of the various sage products in flotation.

[6]"The Big Bonanza," by Dan De Quille (William Wright); American Publishing Co., Hartford, Conn., 1877, pp. 138, 140.

In 1913 James Hebbard,[7] in describing flotation at the Central mine, Broken Hill, Australia, comments as follows:

> Thus nature, in close proximity to the vast bodies of complex ore, has provided the means for the concentration of such ores, for the essential oil of the Australian eucalyptus is one of the best-known media available for the successful exploitation of refractory Australian ores.

The same may be said of our Western sage brush, except that it yields a greater variety and perhaps even better flotative agents than the Australian eucalyptus. Even though man has not, nature has been exceedingly kind to the flotation process.

Copper in the Far North

The report of Rudolph M. Anderson in the New York *Times* of Aug. 17, 1916, on the findings of the southern Arctic party, under Stefansson, which has just returned to Nome after having been in the North for over three years, refers to an interesting find of native copper. Referring to the country northeast of Alaska, Dr. J. J. O'Neil, of Ottawa, the geologist of the expedition, says:

> The geological formations are varied and complicated here, but we gained much valuable information in tracing the contacts of the copper-bearing diabase rocks with the sandstones, shales and granites found in this region. The geological results, the chief work of the party, are very encouraging, for in addition to the previously known deposits, a great field was mapped and investigated where native copper is widely distributed in extensive amounts.

In commenting on the report, Dr. Chester A. Reeds, assistant curator of the Division of Geology and Invertebrate Paleontology of the American Museum of Natural History, says in the *Times* on Aug. 18, in regard to the copper discoveries:

> The finding of a great field of native copper in the vicinity of the Copper Mine River, in the neighborhood of Prince Albert Island, will not only prove of great value to the business world, but it will afford scientists an opportunity for displaying their ingenuity in finding an outlet from a region that is still unopened in a commercial sense.

When asked how the copper fields in the Copper Mine River region might be opened to commerce, Doctor Reeds replied that two routes might be worked out, but that either could be used only during the open season; that is, during August and a part of September. For a western passage he tracel a route from the mouth of the Copper Mine River through the Dolphin and Union Straits from Coronation Bay, past Cape Parry, across Beaufort Sea (ships always keep in sight of land across this water), past Point Barrow and around the west coast of Alaska into Nome. From Nome it would be necessary to go on to Seattle in order to obtain sufficient facilities for shipment by rail.

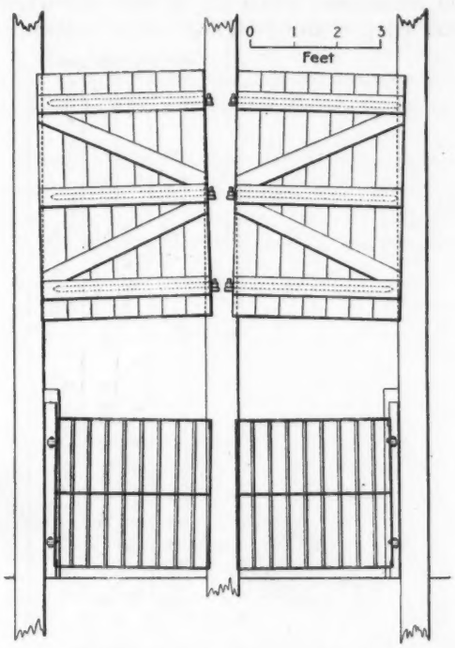
Doctor Reeds estimated that from the mouth of the Copper Mine River to Point Barrow would be about 1,100 mi.; from Point Barrow to Cape Lisburne, Alaska, about 300 mi. more, and from there to Nome would add about 350 mi., completing a journey approximately 1,750 mi. long. A second route, approximately 1,800 mi. long, was traced via Baffin Bay. This way led between Victoria Land and the Dominion of Canada, through the Dease Strait, across the Queen Maud Sea, through the Victoria and Franklin Straits into Peel Sound, and from there through Barrow Strait into Baffin Bay. From Baffin Bay the route led down the east coast of Labrador to a point like St. John's, Newfoundland.

[7]"Flotation at the Central Mine, Broken Hill," James Hebbard: "Proc. of the Austral. Inst. of Min. Eng.," Nov. 10, 1913.

Details of Practical Mining

A Self-Closing Shaft Gate*

After trying out several kinds of shaft gates at the Santa Gertrudis mine, Pachuca, Hidalgo, Mexico, the management finally decided on the type shown as being the simplest and most efficient. The gate is merely swung



SIMPLE SELF-CLOSING SHAFT GATES

off center so that it closes by gravity without undue jar. All shaft entrances are provided with these gates. The wooden upper gate shown in the illustration is used to protect anyone standing at the shaft from falling rocks.

Using Dynamite

There was an inquiry recently concerning the use of dynamite to remove die keys in drop-hammers, says E. W. Wrigley in *American Machinist.* While I have never used dynamite for that particular job, I have often used it to remove broken shafts from gears and other similar work.

We sometimes have large steel gears or drums come into the shop with the shafts broken. We first try to remove the shaft with the hydraulic press, but if it does not start after one or two attempts, we resort to powder. The whole thing is rolled out into the vacant space in front of the shop and far enough from any building so that the concussion will not break windows, and the gear blocked up if possible so that the charge can be put on the end of the shaft and blow downward. Then the sticks of dynamite are broken up so that they can easily be piled on the shaft and covered with a piece of wet burlap. About 2 ft. of ordinary fuse is attached and the steel gear with a 5-in. shaft that usually breaks close to the hub. As it is necessary to shrink this gear on the shaft with more than the ordinary allowance, it is hardly charge fired.

One type that we often start this way is a large cast- ever possible to remove the broken piece with the hydraulic press. So we block the gear up as solidly as possible with timbers, and use four sticks of 40% powder on the end of the shaft. Occasionally a second shot is necessary, but usually the first explosion moves the shaft about ¼ in. in the hub and it is pushed easily the rest of the way with the press.

It must be remembered that the force of the blow probably will crush the shaft a little and cause it to bulge slightly 1 in. or 1½ in. from the point of contact. If the shaft happens to be the same size for its whole length, this bulging part will have to be reduced before it can pass through the hub. Another thing to remember, if the gear is keyed, is which way the key tapers, so that it will not be forced the wrong way and the gear consequently broken.

Steam-Shovel Safety Suggestions

The following suggestion for the safe operation and maintenance of steam shovels is taken from a recent issue of the *Excavating Engineer,* and their observance should reduce the risk of operation.

A cranesman on a Bucyrus 70-ton shovel went up on the boom to tighten the U-bolt on the saddle block. While he was pulling the wrench, it slipped from the nut. He naturally lost his balance and fell over, his foot coming in contact with the thrust-lever on the boom engine, allowing the steam to be turned on. It went off like a shot. He had hold of the larger gear to save himself from falling to the ground, and before he had time to think, his hand was caught between the gear and pinion. The eventual result of this was amputation, leaving this man a cripple for life. Now while this is only one instance, this shovelman, as well as many others, had been told when going up on the boom to do work on the boom engine, that he should shut the steam off in order to avoid accidents.

No man has any business doing any work on any part of the shovel while the steam is on. If you were working on your swinging or hoisting engine, some person might come in on the front of the shovel and walk among the levers. His shoulder might open the throttle. You of course would be in a stooped position, not noticing what was going on. An injury under these circumstances is almost certain.

In changing dipper teeth, some shovelmen have a habit of doing it with the dipper handle suspended. This is a most dangerous practice. A man may be standing

*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

under or in front of the dipper which is hanging in the air. Suppose the steam got low in the boiler and the boom engine started to move. Do you think this man could get away in time to prevent a serious and perhaps fatal accident? To change dipper teeth, the dipper should be set on a small bank or loading track. If you have no bank or loading track available, it should be set on some blocking. When the rivets are cut or the bolts taken out, raise the dipper and the teeth will most likely fall off with little resistance. If a man is needed to pull them off, be sure to keep your cranesman at the throttle of the boom engine.

In putting new or repaired teeth on the dipper, reverse this practice. Place the teeth on the dipper while it is hanging in the air, with the cranesman still at his post keeping a watchful eye. When this is done, place the dipper on the blocks or on the bank and put your bolts and rivets in. You will then be living up to the rule of safety first. Be sure you are right, then go ahead.

A Reinforcement for Concrete Dams

It is highly desirable in constructing a concrete dam to have the horizontal reinforcement continuous and preferably secured by a suitable anchorage at each end. This aids materially in assuring a solid formation and tends to produce a monolithic structure.

A dam of this character constructed in mountainious country is subject to serious limitations in the choice of material, due to transportation difficulties. Where animal pack trains are the only method available, twisted steel rods are impossible. Metal rails, pipes, etc., are too massive to make possible the use of pieces of the proper length.

Under such conditions a flexible cable may be considered to be most applicable. This could be cut to the required length previous to packing and wound up in a roll which lends itself well to pack-train transportation. Where a tramway has been in operation for several years and has hence undergone cable renewals, there is a sufficient supply. The cables are freed from the oil that they had absorbed, by the simple expedient of burning it out. A fire is built and covered with several rolls of the cable. After the initial rolls are started, sufficient fuel is provided by the oil. In this way the cables are made thoroughly dry and are in no way injured for use in reinforcing.

A Prospector's Hammock

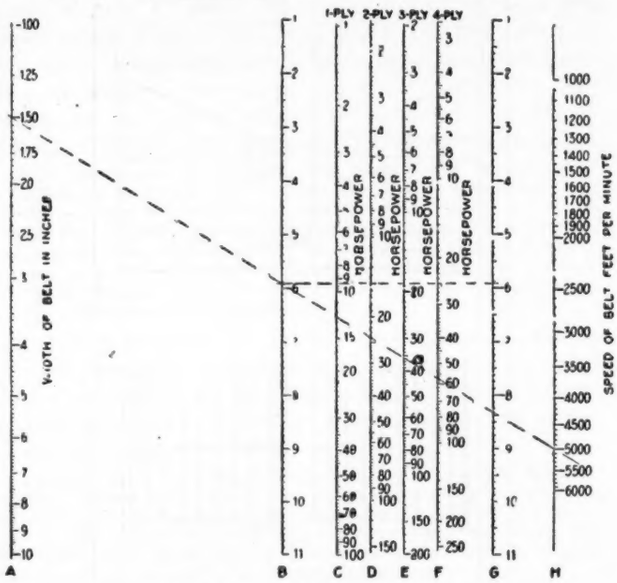
Having spent many uncomfortable nights in various bunkhouses and shelters of dubious comfort, a prospector became convinced that some portable substitute would have to be provided. Working in the North where trees were abundant, he tried the renowned pine boughs. After spending half an hour every evening chopping branches and placing them in the approved way, he turned in always to find at least one branch poking through the boughs. In the course of his work he came to a seaport and told a sailor of his troubles. The sailor smiled and said he could fix him up in a very short time. He got a 7-ft. piece of heavy canvas and put 6 grommets in each end. A little deft work on some cotton line soon made the ends and the prospector was the owner of a hammock that gave him his allotted sleep. Harness pins kept the blankets in, and after he had mastered the difference between turning over and rolling over, his sleeping question was settled. The hammock served as a pack roll in the daytime.

A Practieal Belt Chart*

By W. F. Schaphorst†

The accompanying table has been found useful in the solution of the usual belting problems containing the factors of width, speed and horsepower. A straight-edge is used with the table. As an illustration the following example is given:

What horsepower will a 1.5 in. belt pull when running at 5,000 ft. per min.? Find 1.5 in column A. Find



A PRACTICAL BELT CHART

5,000 in column H. Connect the two with a straight line. This straight line cuts column B between 5 and 6. Find the corresponding point in column G (that is, between 5 and 6). Lay the straight-edge across as indicated by the dotted line. The points of intersection with columns C, D, E and F give the horsepower that 1-, 2-, 3-, and 4-ply belts will transmit. A 1-ply belt would therefore transmit a little over 9 hp.; a 2-ply belt would transmit 15 hp.; a 3-ply belt would transmit about 19 hp.; a 4-ply belt would transmit 25 hp.

Of course the chart can be used to find other factors equally well. If it is desired to transmit 100 hp., for instance, with a 3-ply belt, assuming that the belt is to run 4,500 ft. per min., the final point falls between the 8- and 9-in. points, but so much closer to the 9 that the 9-in. belt should be used.

In Sinking Delprat Shaft on the Proprietary mine, Broken Hill, Australia, from the surface, the bottom of the shaft was illuminated by means of rays of electric light thrown down the center by means of a parabolic reflector and a mirror placed on the surface at an angle of 45°, says E. J. Horwood in a paper on Broken Hill mining methods presented at the New York meeting of the A. I. M. E., February, 1916. In order to avoid shadows, the dividing timbers were left out until the sinking was completed. Operations were thus materially facilitated, especially as there was a considerable quantity of dripping water.

*Copyright, 1916, by W. F. Schaphorst.

†Engineer, Woolworth Building, New York City.

Details of Milling and Smelting

Francis Automatic Pulp Sampler

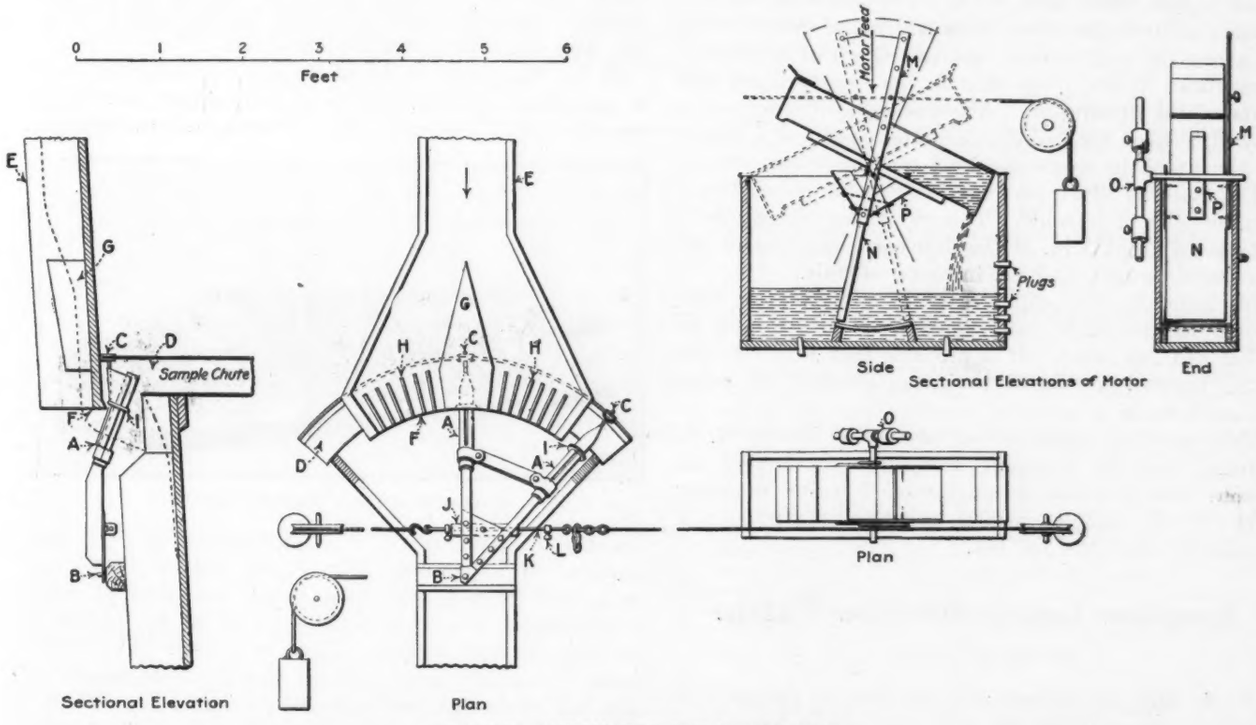
A pulp sampler that can be depended upon for accurate work and yet which may be readily constructed by a carpenter and blacksmith is shown in the accompanying illustration. The instrument is of the traveling-slot type, the motor a modification of the well-known tilting box, and the drive a wire stretched between two pendent weights.

The two traveling slots *A* are carried on the triangular framework pivoted at *B*, whose opposite extremities are supported above a circular track by the rollers *C*. The slots are of equal width, cut in heavy galvanized sheet-iron tubes of 2-in. diameter, with the edges of the slots turned up to provide cutting edges.

As best shown in the sectional elevation of the sampler, the slotted tubes fit over wooden arms attached to the center pivot plate of $\frac{1}{16}$-in. iron. The supporting rollers *C* revolve on stout wire nails used for spindles, which are fastened to the lower ends of the slotted tubes by the metal saddle pieces soldered to the tubes, as shown. The open ends of the tubes discharge into the semicircular sample chute *D*, as the triangular frame, actuated by the drive wire, revolves about its pivot, causing the slots to oscillate beneath the pulp stream flowing from the launder *E*.

It is contended that half the trick of accurate sampling consists in the proper disposition of the pulp stream previous to the sampler cut. If the stream is too deep, its surface velocity, particularly at the launder discharge lip, becomes excessive and is the cause of the worst loss by splash. A depth of 2 in. is suggested as a good general limit. In the Francis sampler the depth of the pulp stream is reduced by widening the supply launder, as shown, as it approaches the discharge lip *F*, splitting the current with the wedge-shaped obstacle *G* and furthering the more equal distribution of the stream along the periphery of the discharge lip by the vertical radial guides *H*.

Important details that should be noted in the sectional elevation of the sampler are the receding section of the under edge of the discharge lip *F* and the circular-



FRANCIS AUTOMATIC PULP SAMPLER

plate drip ring *I*, which prevent contamination of the sample by drip from the exterior of the slotted tube.

Movement of the sampler tubes beneath the pulp stream is effected by the drive wire, which is attached to the ends of the socket bar *J*, of $\frac{1}{4}$x1$\frac{1}{4}$-in. iron, which revolves freely upon its pivot pin without play. The socket-bar ends are turned down at right angles and pierced with a $\frac{1}{2}$-in. hole to allow the free passage of the $\frac{3}{8}$-in. drawbar *K*, whose movements in the socket bar are regulated by the setscrews *L*. These setscrews are used after the motor has started up, to effect the final adjustments for stroke so that the sampler frame and tilting box bump home simultaneously, regardless of any previous movement of the drive wire, thus accomplishing satisfactory sampling movement.

The most noteworthy feature of the tilting-box motor, as best shown in the end view of the illustration, is that the power lever *M*, which is attached to the drive wire, is screwed to an independent paddle board *N*, which swings freely, within limits, about the axle of the tilting box. The axle of the tilting box is rigidly attached to it and carries on one side a vertically set balance rod *O*, which is of ¼-in. pipe and provided with sliding weights adjustable by setscrews. With these weights the sensitiveness of the tilting box, as a whole, can be controlled to a nicety, and consequently the water charge per stroke and the strength of wire pull are easily adjusted to the work.

The tilting box illustrated is 7x8x34 in. and capable of a maximum pull of about 20 lb. Only the last half of the full downward stroke of the box is utilized for power. As the box fills with water, it falls with considerable acceleration, thus gaining power until it strikes the bracket *P*, attached to the paddle board. The force of the impact, however, is largely absorbed in overcoming the inertia of the drive wire, stretcher weights, etc. The drive-wire pull starts with the revolution of the paddle board in the water bath below. The depth of its immersion controls the speed with which the slotted tubes cut across the pulp stream, and this depth of immersion is regulated by the plugs seen in the side sectional elevation of the illustration. About an inch of clearance is allowed between the paddle board and casing as a bypass for the water to regain its level ere the return stroke.

The machine illustrated was built to sample a stream 5 in. deep by 12 in. wide. This particular design effects a stroke of about 5 in. at the drawbar, the travel of the drive wire being 1 to 2 in. in excess of this.

In sampling the pulp stream it is imperative that the cut should not be made too rapidly—there must be no bat and ball effect. It is probable that 1 yd. per sec. is the highest safe speed to insure accuracy of cut—less speed would be safer.

This sampling machine was devised by Walter R. S. Francis, and the foregoing description is largely excerpted from his description given of it in discussing Taylor's pulp sampler in the Institute of Mining and Metallurgy, Bulletin No. 141.

Empire Long-Stroke Table

By John Gross*

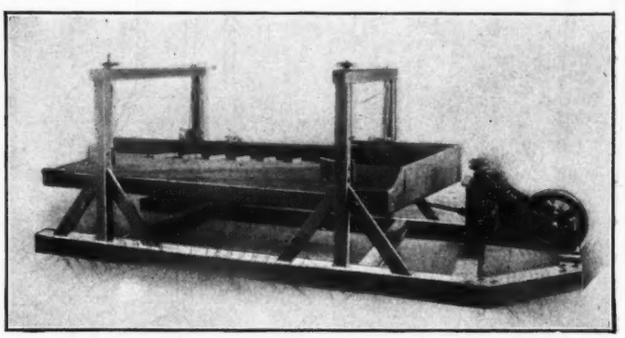
A new table that differs radically from the present type of concentrating tables has been tried out in two of the mills at Idaho Springs, Colo. This table has been developed during the last three years at Empire, Colo., and has been called the Empire table.

The deck of the table, as seen in the accompanying illustration, is of the same general shape as the Wilfley, is riffled somewhat similar to other tables and receives a reciprocal movement through a head motion. At this point it departs materially from the general lines of operation heretofore employed for concentration. The deck is suspended from above and is given a long reciprocal motion longitudinal to the table. A stroke as high as 6 in. is used. It would seem at first glance that such a long stroke would defeat the result desired, but owing to the method of applying the wash water, a rapid and perfect separation takes place. The wash water is fed to the table from behind baffles that, together with the motion of the table, cause an eddy to be formed that accomplishes the result of separation with a very small amount of water.

The forward stroke of the table is gentle, and at the end is retarded slightly by the mechanism and the weight of the table. A spring pressure comes into play only at the end of the forward stroke. The return stroke is thus assisted at the start and given a momentary acceleration due to the stored tension. At the same time the deck drops slightly away from the ore bed along the arc of a circle.

The result of the peculiar motion and the long stroke is that the bed is kept loose. This prevents packing and allows the rapid stratification of the pulp. The mineral moves forward rapidly, and the tails are washed off quickly, thus giving the table a large capacity. The shape of the riffles assists in this work. They are made of sheet metal bent up in channel form, open at the top, and are so placed on the deck as to allow the tails to wash off quickly. As the number of strokes is considerably less than ordinarily used (135 strokes or less per minute), the table runs with little vibration and therefore does not require heavy foundations.

At the Staley mill in Idaho Springs this table has been in operation for four months on the coarser portion of the mill feed. The material is 30-mesh and concentrates



EMPIRE LONG-STROKE TABLE

about 3:1. The table is given 135 strokes of 5 in. per minute. It is handling 37 tons, dry weight per 24 hr. on a 4x10-ft. deck and could handle considerably more if necessary. The table is using about 10 gal. of water per minute and requires ½ hp. to run it. The heads going to the table assay 0.20 oz. gold and 8.40 oz. silver. The tails from this head assay 0.03 oz. gold and 1.90 oz. silver. This, on a concentration of 3:1, is 90% gold and 84.9% silver extraction.

At the mill of the United Mining, Milling and Tunnel Co. at Fall River, Idaho Springs, one of these tables is handling the entire unclassified product from 5 stamps crushed to 30-mesh. The table is run at 135 strokes per minute with a 5-in. stroke. It is claimed by the management that an extraction of 87½% is being made. The value in the ore is mainly gold.

During the development of this table at Empire it was operated on dumps ranging in size from the finest sand to ½-in. material, and a clean product was obtained. Owing to the long, slow stroke used and the peculiar water current, it is possible to treat coarser material, such as is now attempted only on jigs. Further work on coarse material is about to be undertaken.

*Mining engineer, 523 McPhee Building, Denver, Colo.

Company Reports

Rochester Mines Co.

Rochester Mines Co., Rochester, Nev., reports a net profit of $45,751 for a period beginning May 1, 1915, and ending May 15, 1916; $92,550 was also realized from the sale of preferred stock. After writing off the discount on the new stock issue sold there was a surplus of $24,451. The company has now issued and outstanding 2,148,791 shares of stock of a par value of $1. Liabilities amounted to $30,355 and current and working assets totaled $40,722. All the leases on the company's property were purchased at a cost of approximately $40,000, including all machinery and equipment as well as all broken ore at hand, excepting the ore on the dump on Lease No. 2, known as the Codd Lease. It is stated that the lessees had naturally made an effort to extract the greatest amount of high-grade ore with the least possible expense, without any regard to the future of the property as a workable mine. The company is now conducting systematic development work in order to mine all the ore in the most economical manner. Power is furnished the mine by the Nevada Valleys Power Co., which derives its power from the Lahontan Dam, a Government irrigation project 85 mi. distant. This power is furnished at $8 per horsepower per month. It is estimated that the company has approximately 10,000 tons of ore broken in the stopes and as more storage room is made available this amount is expected to be increased to at least 40,000 tons of broken ore by the end of the present year. The mill has been increased in capacity from 100 to 120 tons per day, and extraction has been increased 2%. Further minor improvements are under way, which it is stated, will result in increased efficiency. At present 93% of the ore is ground to 200 mesh. The accompanying tables give details of costs.

MINING COST STATEMENT
Aug. 15, 1915, to May 15, 1916 (9 months)

	Cost per Ton
Mining	$1.8810
Tramming	.2973
Timbering	.3541
Surface	.0290
Blacksmithing	.1912
Ore sorting	.0909
Office expense	.0628
Assaying and engineering	.2145
Pipe and track work	.0990
Tramway operating	.1256
Total	$3.3459
Total cost per ton for labor	$2.5632
Total cost per ton for timber	.0815
Total cost per ton for power	.2312
Total cost per ton for explosives	.2455
Total cost per ton for supplies	.2245
Total cost per ton	$3.3459

MILLING COST STATEMENT
May 1, 1915, to May 15, 1916 (12½ months)

	Cost per Ton
Tramming	$0.0524
Crushing and sampling	.1597
Stamp milling	.3316
Tube milling	.5955
Classifying	.0224
Thickening	.0658
Agitation	.5220
Decantation	.1701
Precipitation	.4900
Refining	.1518
Assaying	.0763
Office expense	.0553
Total	$2.6929
Total cost per ton for labor	$0.7837
Total cost per ton for supplies	1.3488
Total cost per ton for power	.5604
Total cost per ton	$2.6929

RECAPITULATION OF COST STATEMENT
Showing Cost per Ton for the Following Months

	Average for 12½ Months, 5/1/15-5/15/16	Average for 5 Months, 1/1/16-6/1/16	For 1 Month, May, 1916
Milling	$2.6929	$2.2878	$2.1399
Mining	3.3459	3.2209	3.1030
Direct mining and milling costs	$6.0388	$5.5087	$5.2429
Indirect Expenses:			
Marketing bullion	$0.2688	$0.1588	$0.1549
Transportation	.5214	.5214	.5214
Taxes and insurance	.0769	.0694	.0452
Reconstruction of water line	.0237	.0780	.1720
Indirect costs per ton	$0.8908	$0.8276	$0.8935
Total direct and indirect costs per ton	$6.9296	$6.3363	$6.1364

Note—At the present time the mill is making an extraction of 92.87%.

Seneca Mining Co. of Michigan reports that expenses for 1915 were $12,763, leaving a balance of liabilities over assets of $179,703 on Dec. 31, 1915. Of the disbursements, $8,592 was for interest, $1,677 for Eastern expenses, $896 for mine taxes and $1,598 for mine expenses.

Wallaroo and Moonta Copper Mines of South Australia during 1915 operations raised 187,500 tons of ore, milling 175,590 tons assaying from 3.07 to 3.30% copper. The concentrator operated on material from the heaps and on slimes with satisfactory results. Sulphuric acid and bluestone were produced as byproducts. About 1,800 men were employed.

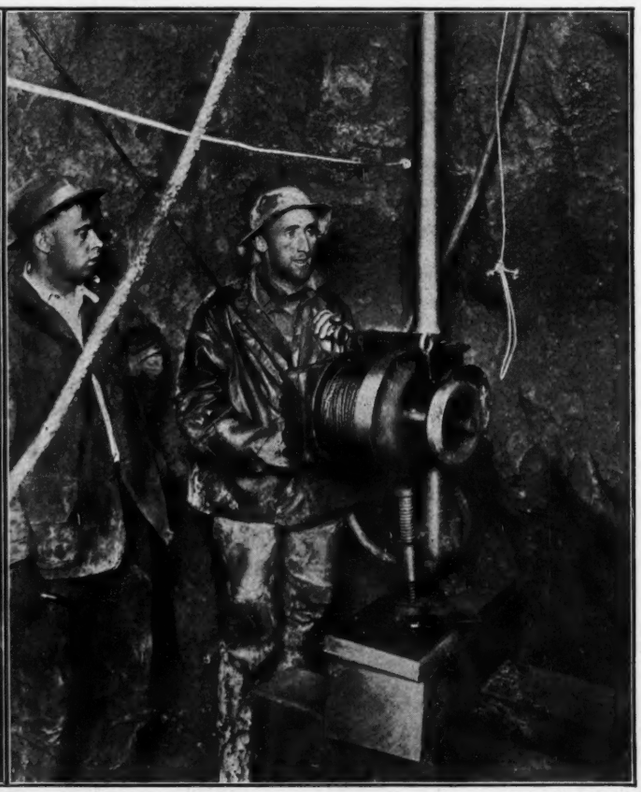
Peterson Lake Silver-Cobalt Mining Co., Cobalt, Canada, for the year ended Apr. 30, 1916, reports a surplus income of $213,291 and dividend payments of $168,127. During the year the Seneca-Superior Co. continued to make regular shipments of ore from the mine; but toward the end of the year the ore reserves were practically depleted, and extensive development of the leased area did not lead to the discovery of any new orebodies. The Gould lease was taken over by a new company called the Mercer Silver Mines, Ltd., which has been actively developing this lease, and one shipment of ore has been made. The company has prospected the Peterson Lake area through Nos. 2 and 3 shafts and have opened up the Nova Scotia territory in which several veins have been encountered, but up to the present time no commercial ore has been found in paying quantities. The production of silver amounted to 2,230,295 oz., of which 2,148,297 oz. came from the Seneca-Superior lease. On the Peterson Lake mine 4,479 ft. of development work was performed at an average cost of $13.79 per ft.

Boulder Tungsten Production Co., Boulder, Colo., reports the company's treasury now contains a surplus of $70,966.75. The net earnings of the company for the past year amount to $125,000. It was recommended that a plan be outlined by the officers whereby the Barker tract of 600 acres, partly developed by the deep tunnel, should be acquired and further improvements of plant provided for. The Clark mill has been in constant operation since its completion last January, handling both company and custom ores. An accumulation of tungsten concentrates held in the mill during the depression in the price of the metal is estimated to be worth $50,000. The total output of the plant during the last seven months is estimated at over $300,000. The sum of $170,000 has been paid out in the purchase of ores from the company lessees and others. The deep tunnel has been advanced 1,000 ft. during the past year. Several promising veins have been cut by the tunnel, three of which have yielded payable ore from development. The tunnel is being advanced as rapidly as possible and within the coming year will probably reach a length of 3,000 ft. and open the Forest Home mine at considerable depth.

Photographs from the Field

THE CONGER TUNGSTEN MINE, THE DEEPEST IN THE BOULDER COUNTY TUNGSTEN FIELD

The Conger mine is the largest producer in the district and is owned by the Primos Chemical Co.; the Conger shaft is 1,100 ft. deep. Except the Beddig, which has a 600-ft. shaft, no other Boulder County tungsten mines have been opened to a depth of 500 ft. About half of the properties in the Colorado field are today less than 200 ft. deep



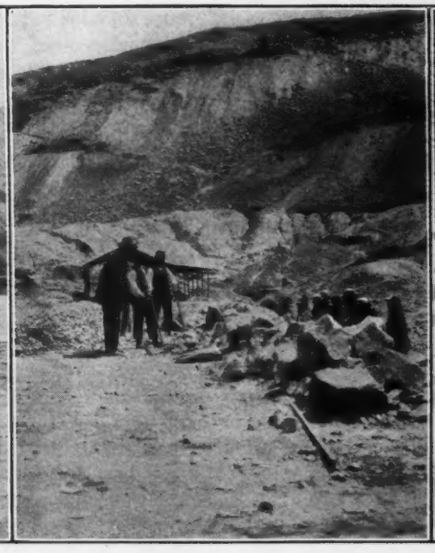
TWO VIEWS IN THE BOULDER COUNTY DISTRICT, COLORADO

Interior of the Duncan tungsten mill; in the background, a Denver quartz mill; "rag plant" or canvas tables in foreground

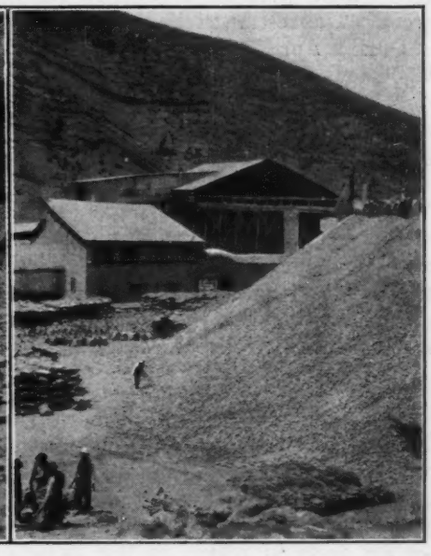
A "Super-Leadville" drill-column hoist in the mine of the United States Gold Corporation, near Sugar Loaf

THE COROCORO DISTRICT, BOLIVIA, WHERE NATIVE COPPER HAS BEEN MINED FOR OVER 200 YEARS. SULPHIDE VEINS LATELY EXPLOITED

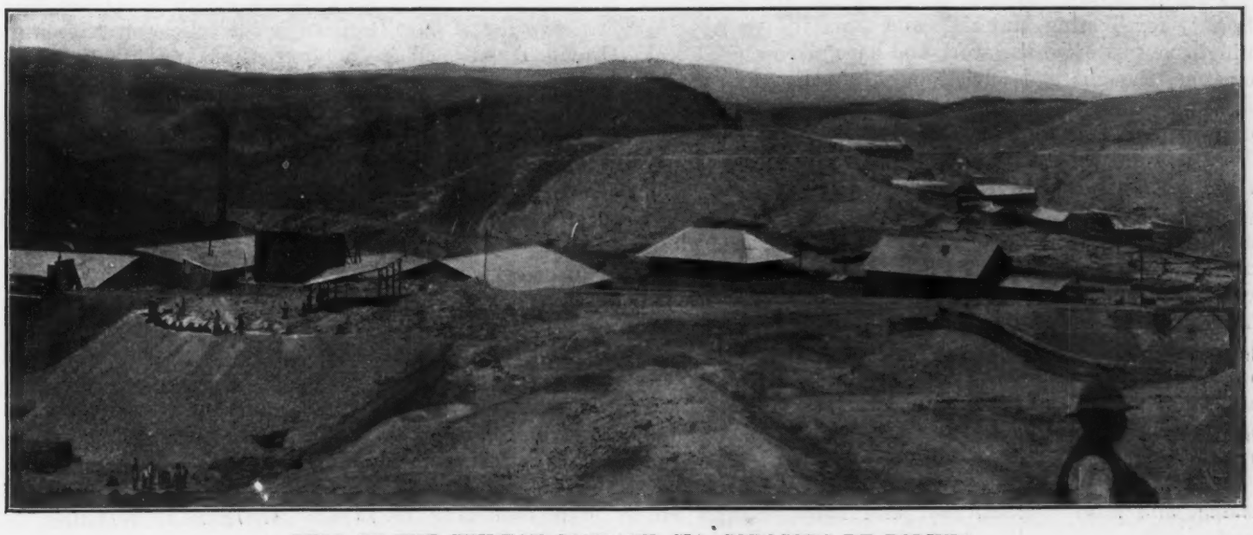
OUTCROP OF SULPHIDE VEIN



WOMEN SORTING ORE AT COROCORO



DUMP OF 20% SULPHIDE ORE



MILL OF THE CHILEAN COMPANY, CIA. COROCORO DE BOLIVIA

Correspondence and Discussion

Joplin Zinc-Ore Production

In the *Journal* of Aug. 19, 1916, page 363, I find the following note:

Curtailment of zinc-ore production in this district is not so great as is indicated by the turn-ins. Reports are based on sales and shipment, and the smelters have been buying so lightly recently that the bulk of sales has been small. There is a constantly swelling surplus of ore, and while numerous mines are down, others continue to operate and pile up a reserve.

According to figures in my possession the following is true:

	July 22	July 29	Aug. 5	Aug. 12	Aug. 19
Shipment	4,980	5,480	4,780	4,810	5,160
Production	4,090	4,390	4,580	4,420	4,860

This is an average shipment for five weeks of 5,042 tons and an average production for five weeks of 4,468 tons. Each week the production was less than the shipment. The reserve stock was decreased 2,870 tons.

During April, 1916, the average weekly shipment was 9,554 tons and the average weekly production was 9,634 tons. The production for the five weeks of July and August, already given, averaged 5,166 tons per week less than the five weeks ending Apr. 29. JESSE A. ZOOK.

Joplin, Mo., Aug. 24, 1916.

[One of our Joplin correspondents reports elsewhere in this week's *Journal* a surplus of 23,000 tons of zinc ore as the finding of special representatives of the Southwest Missouri Safety and Sanitation Association; and a special meeting was to be held Aug. 28 to discuss the surplus and corrective measures.—Editor.]

Sampling of Spelter

Having read the editorial on "Sampling of Spelter," page 358 of the *Journal* of Aug. 19 and also in the same issue the learned remarks on page 331, "Grades and Uses of Spelter," I feel like calling attention to some important facts in regard to this situation as far as the trade is concerned.

I highly appreciate the work done by the American Society for Testing Materials and from the very beginning have supported this work and have given a good deal of time, thought and advice—mostly indirectly—to the deliberations of the committee. The shortcomings, however, of these efforts of the American Society for Testing Materials are that neither buyer nor seller is bound to the rules laid down by the society, with the result that only such concerns with whom nobody would ever have any serious difficulty are guided by these rules, while other firms adopt the rules when it suits them and disregard them when it appears better for their interests. The trouble is that the contracts between sellers and buyers do not embody the rules of the American Society for Testing Materials and that contracts between consumers of metals and producers and sellers of metals are not written uniformly and are written without consideration of coming differences.

In honor of our consumers and producers it must be stated, and most emphatically, that most of them are guided in their dealings by such high standards of business ethics that they will never take advantage of technicalities, and in the copper as well as in the spelter trade it is practically an unknown thing for anybody to try to get out of a contract because the common law might give him a right to do so. With this large class of people it is easy to deal. Unfortunately, there are a small number of people—even of high financial standing—who feel justified in taking advantage of any legal loophole, disregarding the rules of the American Society for Testing Materials as well as the custom of the trade and the question of fair dealings. Protection is needed against this class of people whether they be producers, consumers or exporters. The only remedy I know is to agree upon a uniform contract for the sale of nonferrous metals, such a contract to be agreed upon at a conference of the principal sellers and buyers with the aid and assistance of the engineers and chemists who have done such valuable service for the trade at large in calling attention to the fundamentals by which the quality of metals should be judged. With due and high respect for these gentlemen, it seems necessary to give consideration to the business and legal questions, and if the *Engineering and Mining Journal* will advocate such action and will assist in bringing order out of the chaos, it will have added to its many valuable services rendered to the metal trade and industry a new one.

New York, Aug. 24, 1916. L. VOGELSTEIN.

Specific-Gravity Apparatus

As operator of a cyanide plant I am also interested in any detail that promises to facilitate the ordinary routine practice, or any that might point the way toward securing better results. The *Journal* is always helpful in this way, and I have found a great many articles, particularly in the "Details" department, that have been of considerable help. Occasionally, however, my judgment tells me that the thing is overdone. It is this criticism that I have to make of the article on "Specific-Gravity Apparatus" in the *Journal* of Aug. 12, 1916.

The procedure described by C. R. Olson is one with which I can find no particular fault so far as practicability is concerned, but it does appear to me to be superfluous. With all the articles we have had in the past few years about specific-gravity factors, almost any operator ought to be able to devise any kind of system he happens to need to fill local conditions. It seems to me that a study of Professor Clevenger's exhaustive article in the *Journal* of Dec. 19, 1914, covers the ground thoroughly enough for anyone. His article is clear, exhaustive and authoritative, and any further explanation or description seems unnecessary.

Mr. Olson's method is all right, undoubtedly, but it is only one of many ways of doing the same thing, which almost anyone ought to be able to deduce from a knowledge of the general principles of the subject.

New York, Aug. 14, 1916. CHARLES U. WARRING.

May Unwater Another Shaft on the Comstock

SPECIAL CORRESPONDENCE

The Combination shaft on the Comstock will be unwatered, if the plans proposed by the directors of the Savage, Hale & Norcross, Chollar and Potosi mines shall be adopted by the stockholders. This is a large undertaking and means attacking the water at two points, whereas for the last five years the attack has been at one point for the drainage of the 2,700 level of the Union and Mexican.

The lowering of the water to the 2,900 level has already been decided upon, and the pumps are now on the ground. The station at the 2,700 level is being excavated, and tanks are being installed under the personal supervision of Whitman Symmes. The pumps will be lowered down the winze to the 2,900, and as the winze is known to be opened, by soundings, the management does not anticipate any difficulty until the 2,900 station is reached. This will drain a section two miles in length at a depth of 2,900 ft., as all the mines are connected on the 2,900 level by the drift driven a year ago. Several winzes are being opened to provide ventilation. These are generally found in good condition. Although they have been submerged since 1884, the ore is known to exist in the Mexican and Union on the 2,900 level. The Con. Virginia and Sierra Nevada are practically in virgin ground below the 2,700 level, and in fact a large portion below the 2,500 level. This is all in the Northend Comstock.

The move to unwater the Combination shaft, going to a depth of 3,300 ft., is rapidly crystallizing. An electric pump will be used for this work. Two years ago the shaft was repaired to the 1,900 level, where the water now stands, and it is believed that it is in bad condition below this point, as it has been submerged for many years. The ground is believed to be of good character. At the Northend the water has been lowered to a point below the 2,700 level, and the water in the Combination shaft stands in the 1,900 level, so that connection has not been made between the Northend mines and the Savage, Hale & Norcross, Chollar and Potosi. The Savage mine, occupying an intermediate position, has not been explored below the 2,200-ft. point. It is probable that the drainage of these properties will not be expensive, as it is believed that the steady flow of water in the deep levels will be very small; in fact, that the bulk of the water comes in above the 2,300-ft. point.

The Savage, Hale & Norcross, Chollar and Potosi were among the first locations on the Comstock Lode and were all in active operation in 1860. Litigation over their boundary lines attracted a large amount of attention and extended over a long period of time, but was settled more than 30 years ago. The four mines have a total of 2,571 ft. in length on the lode and have produced approximately $50,000,000.

The reopening of these properties will be made possible by the unwatering of the Combination shaft. This was one of the greatest shafts ever sunk, and in 1886 had reached a depth of 3,265 ft., at that time the deepest excavation known in the world. It was sunk vertically in four compartments of extra-large size, and the timbering was extraordinary. It is stated that the shaft cost more than $2,000,000 to sink and equip. The pumping of this shaft ceased in 1886 because of the flooding of the Gold Hill and the Southend mines in February, 1883, which stopped all the pumps at that end of the lode and submerged all levels below 1,700, and the stopping of the pumps at the north end of the lode in December, 1884. There have since been other causes that prevented the resumption of pumping, among which were the dispute and dissension among the companies as to the percentage of pumping expense to be paid by each.

At the time of shutting down the pumps, John W. Mackay was opposed, because he believed that the showing was so promising; but Isaac Requa, Alvinza Hayward, W. H. Hobart and others contended that temporary stopping of the pumps might force the Gold Hill companies to coöperate in the pumping, which they had previously refused to do. The death of some of the principals made the abandonment permanent. Plans are now being carefully prepared looking to the most economical and expeditious method of draining the lower levels.

Uniform Mine Taxation

SAN FRANCISCO CORRESPONDENCE

A plan to accomplish uniform taxation of mines in California was considered by a joint meeting of the California Metal Producers' Association and the State Tax Commission. It is said that two plans were prepared, the one given herewith and another more favorable to mine owners, but the former reached the hands of the commission in advance of the meeting and was the only one considered. If the metal producers can obtain favorable action on this plan, it is about the best that can be looked for. It is believed that Amador County is most favored, since it has an assessor who varies his levies according to the profitable operation of the mines. If all counties had assessors of like good judgment, there would be little demand for reform in mine taxation. The following is the plan for uniform mine taxation agreed upon and submitted by the committee on mine taxation of the California Metal Producers' Association and considered at the joint meeting:

THE PLAN FOR UNIFORM TAXATION

Assessment—Valuation for assessment for purposes of local taxation as follows: (A) Surface improvements on the same basis as other property in the county in which they are located. (B) The value of mining claims and real estate, the surface of which is not used for other than mining purposes, at one-quarter of the gross value at the mine of all ores, minerals or metals produced during the preceding year; provided, however, that should the net value of such production exceed one-fourth the gross value, then the net value should be taken as the value of the mining claims and real estate. The net value should be determined by deducting from the gross value: (1) The actual cost of mining and development work performed during the year; (2) the actual cost of freight and treatment on the ore; (3) general expenses, including taxes, insurance, welfare work, cost of workmen's compensation, office expenses at both mine and headquarters, and salaries of all officers engaged in the actual operation or management of the business of the mine; (4) depreciation to the amount of the actual

decrease in value of the surface plant where its value is not fully maintained by repairs and betterments, and where so maintained the cost of such repairs and betterments; (5) allowance for depletion in accordance with the provisions of the United States Revenue laws.

Tax levy—(A) For local (county and municipal) taxes the levy should be the same as for other classes of property in the same county, district and municipality. (B) For state taxation the levy should be 0.5% on the value of the net proceeds for the preceding year, and this should be in lieu of any franchise tax whatever.

The following list shows the mine-taxation systems now in use in the various states:

Alabama—Mines assessed and taxed as other property at 60% of actual value. Arkansas—Mines assessed and taxed as other property at full cash value. Arizona—Four times the net plus 12½% of the gross at full cash value. California—Mines assessed and taxed as other property at their true cash value. Colorado—One-fourth of gross proceeds or net proceeds if in excess of one-quarter gross at full value. Connecticut—Mines assessed and taxed as other property at their true cash value. Delaware—Mines assessed and taxed as other property. Florida—Mines assessed and taxed as other property at their true cash value. Georgia—Mines assessed and taxed at their fair market value. Idaho—Unpatented claims not assessed; surface at price paid Government; orebody assessed at net production. Illinois—Mines assessed and taxed as other property at 33⅓% of full value. Indiana—Mines assessed and taxed as other property at price it would bring at private sale. Iowa—Mines assessed and taxed as other property at 25% of actual cash value, except money and credits. Kansas—Mines assessed and taxed as other property at their true value in money. Kentucky—Mines assessed and taxed as other property at their true value in money. Louisiana—Mines assessed and taxed as other property. Maine—Mines assessed and taxed as other property at full market value. Maryland—Mines assessed and taxed as other property at full cash value. Michigan—Mines assessed and taxed on an ad valorem basis. Minnesota—Iron mines classified assessed at 50% of true value. Mississippi—Mines assessed and taxed as other property at their true value. Missouri—Mines assessed and taxed as other property at their true value. Montana—Annual net proceeds plus price paid United States per acre. Nebraska—Mines assessed and taxed as other property at 20% of actual value. Nevada—Mines assessed and taxed on net proceeds at 80% of actual value. New Hampshire—Mines assessed and taxed as other property at full value; undeveloped mines not taxed. New Jersey—Mines assessed and taxed as other property at full and fair value. New Mexico—Mines assessed and taxed on their net proceeds at 33⅓% of actual value. New York—Mines assessed and taxed as other property at their full value. North Carolina—Mines assessed and taxed as other property at their full value. North Dakota—Mines assessed and taxed as other property at their full value. Ohio—Mines assessed and taxed as other property at their true value in money. Oklahoma—Gross receipts taxed; also ad valorem tax; pay state ¾ of 1% of gross value. Oregon—Mines assessed and taxed as other property at true cash value. Pennsylvania—Mines assessed and taxed as other property; coal 2½% on market value of each ton. Rhode Island—Mines assessed and taxed as other property at full cash value. South Carolina—Mining land not taxed; gross proceeds of mines taxed at true value. South Dakota—Mines assessed and taxed as other property at full cash value. Tennessee—Mines assessed and taxed as other property at actual cash value. Texas—Mines assessed and taxed as other property at full and true value. Utah—Mines assessed and taxed on net annual earnings at full cash value. Vermont—Mines assessed and taxed as other property; mines and quarries exempt from taxation for 10 years. Virginia—Mines assessed and taxed as other property at fair market value. Washington—Mines assessed and taxed as other property at 50% of their true and fair value. West Virginia—Mines assessed and taxed as other property at full and fair value. Wisconsin—Mines assessed and taxed as other property at full value. Wyoming—Mines assessed and taxed on gross product at full cash market value.

A Large Quantity of Ozokerite, at first supposed to be paraffin, has accumulated from the oil wells in the Thrall field, situated 30 miles north of Austin. It is stated that ozokerite is much more valuable than paraffin. The discovery that the strange product is ozokerite was made by Dr. Schoch, head of the chemical department of the University of Texas.

On Reporting the Copper Market

We reprint the following communication from the Bisbee (Arizona) *Daily Review* of Aug. 13:

New York, Aug. 7, 1916.

Editor, Bisbee Review, Bisbee, Ariz.

Dear Sir:—Now that not only the state valuations of mining properties, but the wages and salaries paid officers and employees of the copper producers in Arizona depend so directly upon the quotation for copper as given by the "Engineering and Mining Journal," it is of extreme importance that this quotation should properly, and as accurately as practicable, represent actual and bona fide transactions in the metal. When the price of copper is ascending and consequently wages are increasing, from month to month, little or no criticism is directed at the quotation, but when, as in the months of June and July, the market was practically stagnant and little or no business transacted, except at figures far below the April and May prices, there is naturally created a desire to inquire into and ascertain the accuracy of the quoted prices. In view of the importance of this subject and of the interest which the local public necessarily has in it, I have recently, through personal interviews with W. R. Ingalls, editor of the "Journal," and through a comparison of past statistics, gone very carefully into this subject and am sending you herewith the result of my investigations.

The question of determining the actual selling price of the copper metal from day to day is one of extreme difficulty. Copper, under conditions existing at present, is seldom or never sold for immediate delivery, as there is practically no unsold metal in the hands of producers, and such transactions as are termed "spot" usually consist of "seconds," or old copper, which is remelted. The quotations, therefore, given in the "Engineering and Mining Journal," say for the month of July, represent the actual price which the consumer agrees he will pay for certain amounts of copper the delivery of which may not occur until the late autumn or the early part of 1917. Most of the copper producers sell their output ahead; that is, as crude copper produced at their smelters in one month will, under normal conditions, not reach the market as wirebars, etc., for from three to four months, they endeavor to sell their output for at least this time in the future. Realizing the momentous importance and how much depends upon the accuracy of the "Engineering and Mining Journal" quotation, Mr. Ingalls personally keeps in close touch with the producers and sellers of the metal and receives from them, in confidence, memoranda of their sales and the price and time of delivery of their output. From an average of these transactions is compiled the daily, weekly and monthly quotation published by the "Journal."

That experience has shown that these quotations are as accurate as is humanly possible to compute them is exemplified by an average quotation over a period of months or years with the actual prices received from sales of copper by the large producing companies.

The figures which I will cite below are all of record in the annual report to stockholders of Phelps, Dodge & Co. When the market is subject to violent fluctuations, or where there is a steady increase or decrease in the price of the metal, the prices realized during any year for copper "produced and delivered" may be very different than the average price for copper "produced and sold." This is due to the condition, as above stated, of selling ahead.

TABLE OF PRICE COMPARISONS

	E. & M. Journal Quotations	Price Rec'd. for Copper Sold and Delivered by P., D. & Co.
1909	12.98	13.03
1910	12.74	12.83
1911	12.37	12.36
1912	16.34	15.50
1913	15.27	15.35
1914	13.60	13.56
1915	17.27	16.05
Average	14.37	14.09

I am just in receipt of a copy of the table of copper sales in 1915 and from the year 1905 to 1915 inclusive, published in the "Engineering and Mining Journal" under date of Aug. 5. These figures are of great interest, and the accompanying explanation and analysis shows why the receipts from the sale of copper by one producer may differ through a yearly period from another, yet average the same through a space of two or more years.

My attention has been drawn to the very great discrepancy between the "Engineering and Mining Journal" quotations and those which are printed almost daily in the local press and which apparently emanate from brokerage concerns. These latter figures always appear to be from 2 to 5c. per

lb. higher than the official quotations and not only do not represent actual transactions in the metal, but are obviously intended to encourage dealings in copper securities by the inference which they carry that profits in the standard stocks are greater than they actually are.

With reference to the sliding wage scale, while it is undoubtedly a fact that while the "Engineering and Mining Journal" quotation for the month of July was 23.865c. per lb., the producing companies have been receiving, during that month, a considerably higher price for the copper which they delivered. This condition, as can be readily seen, is equalized over a period of months, and it is unnecessary to point out that while the quotation governing the sliding wage scale for the months of May and June was 28.625 and 26.601 respectively, per pound, the actual prices realized by the producing companies for their copper, which as a matter of fact had been sold months before at the then prevailing price, was very much lower. In fact, one of the large producers, booking perhaps the largest individual order for copper ever placed in this country, was selling a large part of its output for 20c. per lb., while paying wages on a basis of from 22 to 27c.

It is evident, therefore, that the business of copper selling is largely dependent on the personal judgment of market conditions by the selling agents, and it is consequently the object of Mr. Ingalls to endeavor to arrive at what might be considered the actual market value of the product through the averaging of the prices obtained by all or many of the transactions that are consummated.

After a very active demand for the red metal during the months of April and May, there has been little or no movement during June and July. I am glad to state, however, that there are present indications of a more active buying movement, and while it is not our opinion that the prices will be as high as the highest that have been obtained during the year, they will materially exceed those obtained for the small amounts of copper which changed hands during the past two months.

There have recently been rumors, which came to my attention, that statements have been made that the large copper-producing interests have financial control of the "Engineering and Mining Journal" and that it is naturally to their interest that the copper quotations therein should be under, rather than over, the market, on account of the bearing which it has on the sliding wage scale. Did this condition obtain, which it does not, the copper producer or seller would be injuring himself through the publication of such a quotation, as whereas, a portion of the high price of copper goes to labor, a larger proportion goes to the producer, and it is obvious that the producer will obtain as much as he possibly can for his output and not give the purchaser and consumer the impression that the price of copper is lower than that which he is asking for it. I have investigated the ownership of the "Engineering and Mining Journal" and can refer you to the issue of Apr. 15, 1916, which, in accordance with existing laws, publishes a statement of its ownership and management, etc., and its list of stockholders. In addition to this I have the emphatic personal assurances of its very reputable and distinguished editor that not one share of stock nor any bonded indebtedness is owned by any copper producer or selling agent, individually or as a corporation.

Yours truly,
WALTER DOUGLAS,
Vice-President, Phelps, Dodge & Co.

George W. Riter

SPECIAL CORRESPONDENCE

George W. Riter, well known in Utah as a mining engineer, died in Salt Lake City, Aug. 20, as the result of an apoplectic stroke. He was born in Salt Lake in 1871, the son of Levi E. Riter, a pioneer of 1847, and Annie Riter. He attended the University of Utah and went from there to Stanford University in 1893, from which institution he was graduated in 1896, with a degree in mining engineering. On returning to Salt Lake, he became connected with the Eureka Hill Mining Co. in Tintic as secretary and general manager, which position he held until about four years before the time of his death.

Mr. Riter was city engineer for Salt Lake City from 1904 to 1906. Three years ago he went to Washington as the representative of the mine producers of Utah before the Ways and Means Committee of Congress, then engaged in the preparation of the present tariff law. Mr. Riter presented to the committee statistics in regard to the tariff on ores, as affecting the Western States. He was for nine years treasurer and a member of the executive committee of the Tintic Mine Owners' Association. He was a member of the American Institute of Mining Engineers and the Mining and Metallurgical Society of America. Funeral services were held at the University Club of Salt Lake City, where Mr. Riter for a number of years had made his home. He is survived by four brothers and a sister.

Zinc-Tailings Treatment

Zinc ores of the character occurring in the well-known Franklin Furnace, N. J., deposits have a calcite gangue in which more or less of the original CaO has been replaced by MnO, MgO, etc. The result of such replacement is to increase the gravity of the gangue particles to a point more closely approaching that of the willemite-ore particles, thereby increasing the difficulty of separation by methods at present employed. As a result it is claimed that the mill tailings average upward of 5% zinc in such form and size that further separation by gravity mill methods, such as jigging, is impractical.

The new process now to be described contemplates the further separation of the metallic from nonmetallic particles by calcining the inclosing calciferous particles, after which a separation is readily made.

The ore is subjected to an oxidizing heat, in any of the well-known forms of calcining kilns or furnaces, by passing it in a thin traveling stream in proximity to flame or flame gases. Any temperature above 700° C. may be employed, though it is desirable, particularly in attaining an overburning, to heat to around 950° C. for producing quicklime, and around 1,050° C. for overburning. Where it is desired to obtain as a byproduct merely a lime of the ordinary properties, just enough water or steam is introduced into the calcines to hydrate the lime, whereupon the latter is reduced to a fine dry dust from which the relatively coarse zinc minerals can be separated either by simple sifting or pneumatic separation.

Where the calcining is done at an overburning temperature, the calcines react slowly or not at all with water. Gangue particles thus treated form brown granules, which may be easily separated from the zinc minerals on the ordinary forms of concentrating tables, jigs, etc., the gangue particles being of less specific gravity than before burning. The inventor prefers a calcination complete enough to expel substantially all the CO_2 in the ore.

It is claimed that in one test of this method, where the original tailings contained 5% zinc and 68% manganiferous calcite, table concentration of the calcines could produce concentrates carrying over 20% zinc in one passage of the concentrator. It is further claimed that the application of this process to present milling methods will allow the preliminary table concentration to make cleaner concentrates, since the willemite thereby going into the tailings will ultimately be recovered in the concentration following calcination. In addition to the increased metallic recovery, the process will increase the capacity of the concentrators.

This process is the invention of Arthur C. Spencer, of Washington, D. C., U. S. patent No. 1,150,897.

Editorials

The Railway Situation

Another week has passed without any settlement of the controversy between the brotherhoods and the railways, but during the week the situation has clarified in many respects; that is, everybody is able now to see just what the railway men demand and there are no longer any illusions respecting abstract problems of social welfare. The theoretical idea of a universal eight-hour day on the ground that a human being ought not to work more hours than that and that society no longer sanctions a more protracted working time was received with general derision. The farmers of the country, who have to work from sunrise to sunset, wanted to know how the principle would be applied in their case, and so on.

No, the railway men never had any idea of demanding an eight-hour day for the reason that they ought not to work any longer. On the contrary, they strenuously resented all ideas of limiting their working time. They want to work more hours, but they want to be paid on an eight-hour basis. In other words, the railway men were simply making a disguised demand for increase of pay. This is the naked truth, which now everybody sees.

The development of the situation was about like this: After the prolonged palavering in New York, when the two parties were unable to agree, they decided to go to Washington and appeal to Cæsar. In Washington the railways found that Cæsar had already prejudged the case in favor of the brotherhoods and was unwilling to entertain even the fair and simple proposal of the railways for arbitration of the whole matter. It looked to the railways as if their case were hopeless. They weakened and were apparently on the point of yielding, when public sentiment crystallized strongly in their favor—probably as much to their own surprise as to that of anybody. This gave the railways their second wind; they braced up and reverted to their original contention for arbitration. In the meanwhile the President and his political advisers, having obviously backed the wrong horse, have been trying to get out of the predicament into which they fell when they made silly sophomoric utterances and threw to the winds the principle of fair play.

The delegates of the brotherhoods have now gone off in a dudgeon and threaten specifically to call a general strike at 7 a.m., Sept. 4. The President is endeavoring to persuade Congress to do something that will relieve the situation, but the outlook for his successful management of that collection of wild horses is not good. The United States is therefore threatened with something like civil war—a war between the mass of the people and a group of unions which have a strong grip on its arteries. These aristocrats of labor say in effect: "Grant our insatiable demands or we will throttle you."

It may be best to let there be a strike, to let the nation see whether a small part of the people is greater than the whole. It may be best to have a settlement of the position of unionized labor with respect to public utilities and necessities once for all. We do not believe that a strike will be so bad as has been pictured. Already the brotherhoods intimate that they will deign to let enough trains run to provision the United States troops and to carry milk to the babies all over the country. Obviously, they see already growing over them the shadow of the contempt of their fellow citizens, which will hang over them like a pall if they carry out the plan that they threaten.

"There's going to be a strike. That's certain. Let's have it. It will clear the air. And that's the only thing to do now," a railroad president declared on Aug. 29. "It will show the people of the country what is really going on in the industrial world." This terse statement summarizes the situation and the common opinion as we go to press.

The Copper Situation

The situation in copper becomes tighter and tighter. Although the mines are producing heavily, the refiners are short in their capacity and they do not seem to be able to increase it rapidly. Refining capacity is now the limiting factor. Not only is it shutting off the output of the mines, but also is it shutting off the reclaiming of a great deal of scrap copper that normally comes back from the rolling mills, wire-drawing mills, etc. A slightly ameliorating factor is the tendency of consumers of crude copper for the manufacture of bluestone, especially in Italy, to turn to the American market owing to their exclusion from the London market. This demand takes care of a considerable amount of American pig copper.

The refiners are making efforts to increase their capacity, but they are checked by the great delays in obtaining machinery and other equipment, the same condition obtaining here as in almost all other lines of construction at the present time. The copper refiners also suffer from the increasing independence of prosperous labor, which does not seem to want to work so hard as ordinarily, for what appears to it to be the excellent reason that it does not have to. This contributes to the restriction of the production of refined copper. In this connection it is to be remarked that the taking of copper by domestic manufacturers also has been restricted owing to similar causes.

During the last six weeks the copper market has experienced a complete reversal of form. Beginning in June there developed a great deal of pessimism in a good many quarters—banking, manufacturing, metal selling, etc.—and there was a widespread movement to anticipate the general decline that was believed to be impending. Manufacturers of copper goods, who found themselves temporarily over-bought with respect to their supply of raw material, appeared in the market as sellers of their surplus and were a disturbing factor. It is understood that some of these manufacturers, who thus disposed of copper that they already had on hand, have lately been buyers again at higher prices. Indeed, there has been

a well-defined belief among producers that a good many manufacturers of copper were short in covering their requirements, and some of the recent urgent buying is attributed to that. Anyway, the present situation is that relatively little copper that the producers expect to turn out previous to the end of 1916 remains unsold. The foreign governments, which made very large purchases early in this year, contracted for deliveries only up to the end of the year, and the time is drawing near when they must buy for delivery in 1917 if they are going to buy at all. Conversations on this subject, between their representatives and the producers, have been going on for several weeks. A very large quantity of copper is known to be wanted. The delay in consummating the transaction appears to be only a matter of agreeing upon the price.

Iron and Steel in 1916

From time to time during the current year we have noted the fact that the blast furnaces of this country were making pig iron at the rate of 40,000,000 tons per year, approximately. This rate was never before reached, and its continuance seemed hardly possible. The half-yearly statement of the American Iron and Steel Association now informs us that the actual production for the half-year ended June 30 was 19,619,522 gross tons, or not far below the total indicated by the monthly reports of the furnaces. The gain over the first half of 1915 was 7,385,731 tons, or 60.4%, and over the second half of that year 1,937,100 tons, or 11%. Taking the half-year reported on with the second half of 1915, the production for the 12 months reached a total of 37,301,944 tons, which is by far the greatest ever reported for this country in a single year, but will in all probability be exceeded by that of the calendar year 1916 when that is completed.

The exceptional nature of the demand and business of the year is shown by the fact that the steel-company stacks made 70.7% of the total iron reported; 29.3% was merchant iron for sale, but of this a considerable quantity was basic and other steel-making irons. Apart from the heavy home demands, the extraordinary sales for export have been almost entirely of steel in finished or semifinished forms. Foundry and malleable iron fell to 18.1% of the total, while forge iron was almost a negligible quantity. Over four-fifths of the iron made went directly to the openhearth furnace or the bessemer converter. The same proportion seems likely to continue until the end of the year. The statement that 344 stacks were in blast on June 30 out of a total of 406 carried on the list shows that practically all or nearly all the available furnaces are active, the number out of blast covering only those that are necessarily under repairs and the smaller number that are still in existence, but are never likely to be blown in again, because of antiquated construction or equipment or because their situation forbids profitable operation except at the very highest range of prices.

We have noted before that the increase in producing capacity which has followed this year's boom has been rather unbalanced. The new capacity is mainly adapted for the production of semifinished steel. This has exceeded the new facilities for the manufacture of finished steel and is very considerably in excess of those for the making of pig iron. The number of new blast furnaces constructed has been comparatively few, and although several others have been started or projected, it will take some time before they are ready for work. No material increase in the rate of pig-iron production will be possible before the beginning of 1917, even if we allow for the better rate of output which usually comes with cold weather.

No official figures are available for the production of steel in the first half of this year, but considering all the conditions, there is little doubt that it was between 19,500,000 and 19,750,000 tons. This does not mean that all our pig iron was made into steel, but it implies that there was a large use of scrap in the openhearth furnaces. We know that the demand for heavy melting steel scrap has been active, and we also know that a great deal of steel—rails, shells and other finished work—was made under specifications that required heavy discards from ingots. These discards, with crop ends and other new scrap, undoubtedly went back into the steel furnace. To that extent they constitute a duplication that always exists, but was probably greater than usual this year. The actual quantity it is impossible to determine. The proportion of steel used is greater each year owing to the declining use of wrought or puddled iron, and to the substitution of steel for many purposes where cast iron was formerly used. This is a banner year for steel, and it will continue to be so until its close. Whether 1917 will equal it depends upon conditions that it is now impossible to foresee.

As Mexico Is

The unhappy condition existing in Mexico is widely known and has given rise to a great deal of discussion in this country, most of which has been given a political twist. Our interest in that country is believed to be due to the large amount of our money invested there. No doubt this is true, and we believe it ought to be. Many of our supersensitive sentimentalists, however, object to that point of view. Let us discard, then, every possible effect of the Mexican internal conditions upon any outside nation and consider the pure facts of the case and how they affect Mexico and her people. Mexico is bankrupt. Her financial system is one in name only. There is no law, and murder can be, and is, committed with impunity. There is no real commerce, no transportation that can be depended upon, no law to which appeal may be made. The majority of the population desires peace, but cannot have it because a belligerent minority requires turbulence as the price of its easy living. It would be a fine thing if some great, unselfish statesman should appear among the Mexican people and succeed in establishing a just and able government, but Mexico is politically anæmic, and during the four years of revolution no man of ideals has appeared. The desire for peace is so strong in the country that three-quarters of the people desire intervention by the United States to put the nation in decent condition. That is not an empty statement, but one that can be substantiated by Mexicans and by many old residents of the country. Mexico is a house in disorder, dominated by a small clique of bullies who prosper on that disorder. The people are pleading for help—mutely, because it cannot be done openly. Was there ever any greater incentive for a benevolent government to perform a humane act than there is for ours to help Mexico?

BY THE WAY

An Ohio investor has written us inquiring about the value of his stock in the Mexican Mines Control Co. We do not know of a mining company by this name, but it sounds like a thinly disguised name for the Carranza government.

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The manifest of the "Deutchland," says the New York *Tribune,* as filed at the Baltimore Custom House, shows that on her return voyage to Bremen she carried a cargo made up as follows: Rubber, 802,037 lb.; nickel, 752,674 lb.; and tin, 181,049 lb.

⁂

It appears that Germany and Austria are contemplating a record purchase of copper. The Boston *News Bureau,* Aug. 12, 1916, notes that through certain representatives these countries are to effect record-breaking purchases of copper, probably the largest lot of metal ever handled in a single transaction. Estimates of inquiry ranged all the way from 250,000,000 to 500,000,000 lb. for delivery next year. Negotiations are understood to have reached the preliminary stage and to call for all metal available for export from this country in 1917, the copper to be stored here until after hostilities are concluded in Europe. It is to be shipped then to Germany, Austria and Turkey.

⁂

Here are some differences of opinion:

"It seemed to me, in considering the subject matter of the controversy, that the whole spirit of the time and the preponderant evidence of recent economic experience spoke for the eight-hour day. It has been adjudged by the thought and experience of recent years a thing upon which society is justified in insisting as in the interest of health, efficiency, contentment, and a general increase of economic vigor." The President of the United States.

"We do not assent to the statement that 'the eight-hour day now undoubtedly has the sanction of the judgment of society in its favor.' We believe that society has not yet recorded its judgment upon this subject." The Presidents of the railways of the United States.

"We want to work as many hours as we please, but we demand to be paid on the basis of an eight-hour day." The Railway Brotherhoods.

There appears to be some doubt respecting the "sanction of society." Query: Do the railway presidents, the railway stockholders, and the railway men play any part in the constitution of society?

⁂

We lately came across an interesting prophecy in the preface to "Mexico of the Twenieth Century," by Percy F. Martin, published in 1907. Mr. Martin wrote:

Another common supposition is that with the disappearance of Gen. Porfirio Diaz, either by reason of his voluntary retirement or other cause, the present condition of peace and prosperity must come to an end. This fear of collapse has been so frequently expressed, and always by individuals who, never having been in the country, can and do know nothing about it, that the world at large has come to believe it.' There has seldom been perpetrated a more complete and foundationless error. While it is perfectly true that the new Mexico—Mexico of the twentieth century—owes practically everything to the long-sustained government of Porfirio Diaz, its regeneration as a nation, its rehabilitation as a power among the countries of the earth, and a force henceforth to be reckoned with, so thoroughly has this great soldier-statesman done his work, so well has he laid the foundations, built up the walls and roofed over the whole structure, that the fabric stands today self-suporting and indestructible, a living and a lasting monument to the man who built it, to his strength, his devotion and his intelligence. But Mexico is no longer in any need of a defender, nor is it now dependent upon its architect. He has built too soundly and permanently for that. Diaz may pass away, but while his name will never perish from record or recollection, his guiding hand can be dispensed with, and that without fear of untoward consequences.

Looking backward, we can pronounce Mr. Martin a distinguished failure as a prophet. There are many people who talk about what will happen in Mexico when times are normal again. They have no clear perception of things. Conditions in Mexico are normal now. They were abnormal in the peaceful times of Porfirio Diaz.

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August Mining Dividends

Dividends disbursed in August, 1916, by 27 United States mining companies making public reports amount to $11,662,719, as compared with $3,637,387 in August, 1915. Iron, metallurgical and holding companies allied to mining paid $8,031,108 as compared with $18,191,785 a year ago. However, the large total of last year included the distribution by Amalgamated of $3.77 per share ($8,702,359) which was a return of capital rather than a dividend. Canadian and Mexican companies paid $1,907,963, as compared with $799,989 a year ago.

The following companies paid initial dividends in August: American Zinc, Lead and Smelting, preferred, First National Copper Co., Mass Consolidated Copper Co., South Hecla Mining Co., United Verde Extension, and Utah Metal and Tunnel Co.

The payment by the Colorado Fuel and Iron Co., preferred, covered back dividends and was the first paid on the stock since 1914. There are still unpaid accumulated dividends amounting to about 29 per cent.

United States Mining Companies	Situation	Per Share	Total
Am. Zinc, Lead and Sm., pfd., l.z.	U. S.	$1.50	$144,840
Anaconda, c.	Mont.	2.00	4,662,500
Bunker Hill & Sullivan, l.s.	Ida.	.50	163,500
Bunker Hill Con., g.	Calif.	.02½	5,000
Caledonia, l.s.c.	Ida.	.03	78,150
Champion, c.	Mich.	6.40	640,000
Chief Cons., s.g.l.	Utah	.05	44,148
First Nat. Cop., c.	Calif.	.25	150,000
Golden Cycle, g.	Colo.	.02	30,000
Hecla, l.s.	Ida.	.15	150,000
Homestake, g.	S. D.	.65	163,254
Jim Butler, g.s.	Nev.	.10	171,802
Mass Cons., c.	Mich.	1.00	100,000
Miami, c.	Ariz.	1.50	1,120,671
Mohawk, c.	Mich.	10.00	1,000,000
New Jersey Zinc	U. S.	4.00	1,400,000
Pacific Mines Corpn., g.	Calif.	.02	12,840
Plymouth Cons., g.	Calif.	.24	58,520
Socorro, g.	N. M.	.05	18,865
So. Hecla, l.s.	Ida.	.15	39,300
Tamarack & Custer	Ida.	.02	35,530
United Verde, c.	Ariz.	1.50	450,000
United Verde Ext., c.	Ariz.	.50	525,000
Utah Metal and Tunnel	Utah	.50	342,749
White Knob Cop., pfd.	Calif.	.10	20,000
Wilbert, l.s.	Utah	.01	10,000
Yellow Pine, l.z.s.	Nev.	.10	100,000
Iron, Metallurgical and Holding Companies	**Situation**	**Per Share**	**Total**
Cambria Steel	U. S.	.62½	$562,500
Colo. Fuel & Iron, pfd.	Colo.	30.00	600,000
Dominion Steel, pfd.	Can.	1.50	105,000
Internat. Nickel, pfd.	U. S.	1.50	133,689
St. Mary's Min. Land	Mich.	2.00	320,000
U. S. Steel Corpn., pfd.	U. S.	1.75	6,304,919
Canadian and Mexican Companies	**Situation**	**Per Share**	**Total**
Amparo, g.s.	Mex.	$0.05	$100,000
Coniagas, s.	Ont.	.25	200,000
Granby Cons., c.	B. C.	2.00	299,970
Greene Cananea, c.	Mex.	2.00	976,828
Hollinger, g.	Ont.	.05	120,000
Rambler-Cariboo	B. C.	.01	17,500
Seneca-Superior, s.	Ont.	.30	143,665
Standard Silver Lead, l.s.	B.C.	.02½	50,000

The totals for the first eight months of the year are as follows: Mining companies, $108,196,603, as against $40,410,582 in 1915; iron, metallurgical and holding companies, $66,397,367, as against $54,825,758 in 1915; Canadian and Mexican mines, $14,538,562, as against $5,297,740 in 1915. The accompanying table shows details of the month's payments.

How Railroads Earn a Dollar and How They Spend It*

Of every dollar earned by the railroads of the United States in 1915 just 69.47c. came from freight they carried. Passenger service, including the revenue from express and mails, furnished 26.54c., and 3.99c. was received from other sources, such as securities they held.

The 69.47c. received from freight operation was contributed in this proportion: Transportation of the products of mines brought in 23.86c., transportation of manufactures yielded 15.10c., carrying farm produce, 11.72c., products of forests, 7c.; animal products, 4.15c.; other merchandise, 4.32c.; miscellaneous freight, 3.32c.

The 26.54c. received from the passenger service consisted of 22.20c. in passenger fares, 2.37c. received for carrying express matter and 1.97c. for carrying mail.

Of every dollar spent by the railroads of the United States in 1915 just 43.20c. went to pay the wages of labor. Material for way and equipment, supplies and other expenses of upkeep cost 16.90c. Fuel and locomotive supplies took 8.12c. Loss and damages absorbed 2.22c. and 4.72c. went to pay taxes. All these items constitute what are known as operating expenses. It will be seen that they took 75.16c. of every dollar the railroads earned.

There remains of the dollar earned in 1915 by the railroads 24.84c. Of this 14.79c. went to pay interest on funded and unfunded debt, 3.97c. was paid out in rent for tracks under lease, 5c. was set aside for dividends and surplus. The tiniest item of all was the 1.08c. left of the dollar and spent for betterments.

Experts say that when operating expenses take more than 70c. of the railroads' dollar, the outlook for the roads is not bright. Last year 75.16c. of every dollar earned was spent on operating expenses.

These are the facts of railway earnings and spendings in 1915. The most significant fact to many will appear to be labor's big slice of the railroads' dollar. The fact that labor gets 43.20c. of every dollar earned by the roads is of the utmost importance in considering the justice of the demands now made by railway employees in train service. They are asking that their present day's wages be paid them for eight hours' work instead of 10 hours. At the very least this means a 25% increase in the pay of these men. The startling possibilities of increase if the men get a day's wage for eight hours' work have been well shown in the following illustration:

Suppose an engineer who now makes his run in 10 hours is paid $5.60, or 56c. an hour; under the proposed plan he would get $5.60 for eight hours, or 70c. an hour, and overtime at $1.05 an hour for two hours. His total compensation would, therefore, be $7.70 if he worked 10 hours, an increase of 37½%. Suppose his train was delayed and the run took 12 hours. On the existing basis of wages he would receive $5.60 for 10 hours and overtime for the extra two hours at the same rate, making his overtime $1.12 and his total pay $6.72. Under the proposed arrangement he would receive $5.60 for eight hours, or 70c. an hour, an increase of 25% an hour, and overtime on a time-and-a-half basis, amounting to $1.05 an hour, an increase in the overtime rate an hour of 87½ per cent. As he would receive overtime for four hours instead of two, his total pay for overtime would be $4.20, an increase in it of almost 300 per cent., making his total day's wages $9.80, an increase of 45%.

The freight engineer in question, then, stands to gain a wage increase of 25 to 45% if the unions achieve their full object. Is such an increase fair, in view of the analysis of railroad expenses given at the outset of this article? Is not a 25 to 45% raise a pretty big jump to make all at once in any wage scale?

The Government has fastened upon the railroads and compelled them to submit every question of rates, which alone determine their earnings, to the arbitrament of the Interstate Commerce Commission. But the Government does not compel the railroad workers to submit their demands to any such arbitrament. Arbitration of railroad claims by other tribunals is unsatisfactory because the Interstate Commerce Commission, and that body alone, is in possession of all the facts about railway affairs. And only on the basis of these facts can a proper decision as to the justice of labor's claims be arrived at.

If the railroads must submit to the rates imposed by the Interstate Commerce Commission, should not the railroad workers be required to submit to the wage rates decided upon by the same body? If it is proper to tell the railroads just how much they shall earn, is it not proper to tell the railway men just what share of those earnings they shall receive?

It will be seen that however much one may sympathize with the desire of the railway men for better pay or better hours, if train operation can be remolded to give them better hours, their problem is only one part of the present difficulties of the railroads of this country. The solution of these difficulties will certainly do as much as anything to determine the fate of Government regulation of public utilities in the United States.

Aiming to refute a statement issued by the railroad brotherhoods to the effect that the ownership of the railroads of the United States is centralized in a few hands, C. H. Markham, president of the Illinois Central Ry., a member of the railway executives' advisory committee, declared:

Some of the newspapers published a statement issued by the brotherhoods seeking to show that the railroads of the United States are owned by a few large investors. This is a marked instance of inaccurate generalization. It is stated that "to a very considerable extent the stock of the American railroads is owned by the railroads themselves," and the Pennsylvania R.R. is mentioned as the owner of stock in several hundred subsidiary companies and other railroads.

This is true, and in the total of 622,000 stockholders shown by the reports of the railways to the Interstate Commerce Commission for 1914 undoubtedly there are many duplications of this condition, which, however, do not affect the result to any great extent.

Investigations made by our committee show that in the returns for 1915, however, most of these duplications are shown and it is possible to ascertain to what extent railway stock is held by railway companies and by the public.

In 1915 the total capital stock of $8,638,000,000 was held by 626,122 stockholders with an average holding of $13,796 each. For all roads with gross earnings of over $1,000,000 the commission has required a report in each case of the names and holdings of the twenty largest stockholders, which will include in most cases the intercorporate holdings.

This has made it possible to separate the stock holdings of railway corporations from those of individuals. Of the 608,318 stockholders in roads of this class 688 are found to be railway corporations, leaving 607,630, most of whom are individuals with an average holding of $9,882 par value each.

While this number undoubtedly includes individuals who own stock in more than one railway, it also includes brokers who hold in one name stock in a single railway for the account of several different individuals. In such cases the number of actual owners of the stock is substantially understated. Also stock frequently stands in the name of an executor or trustee for the benefit of a number of individuals, which leads to another understatement.

Instead of railway stock being held by a comparatively few persons in Wall Street, as is often claimed, the bulk of such securities is held by small investors outnumbering the members of the train-service brotherhoods who are now threatening to tie up the roads, by two to one.

*From the New York "Sun."

PERSONALS

O. B. Perry has gone to Dawson and other points in the Yukon.

George A. Laird arrived recently in San Francisco from Australia.

W. H. Moore, late at Black Diamond, Wash., is now at Los Angeles, California.

G. L. Sheldon, of Ely, Nev., has been examining mining property in San Bernardino County, California.

D. McBride, late with the New York & Honduras Rosario Mining Co. at San Juancito, Honduras, is now at Greensburg, Penn.

A. G. de Golyer, formerly of New York, has been appointed general manager of the Vernon Mining Co., at Ironton, Colo.

W. C. Thomas, of California, formerly with Samuel Newhouse, of Salt Lake, is now in Arizona examining and reporting on mines.

H. E. T. Haultain has been at Jewel, Ont., in the Craigmont corundum district, in connection with the erection of a new corundum mill.

Alex. Chisholm, formerly at the Anvil, has been made assistant superintendent at the Newport mine in Ironwood, the change being an advance.

Charles F. O. Merriam, of Wallace, Idaho, was at Nelson, B. C., last month examining and reporting on the Granite-Poorman group of gold mines.

William D. Manchester, of Rocky Hill, Conn., has been appointed superintendent of the crushing department of the Chile Exploration Co. at Chuquicamata, Chile.

Harrison A. Dunn, who has been imprisoned in Mexico City, was released on Aug. 21 and left at once for Vera Cruz. Mr. Dunn is expected to arrive in New York very soon.

Charles L. Harrington, formerly superintendent of the American Rare Metals Co., is now manager of the Overall Mining Co. His present address is Dove Creek, Colo.

Charles T. Kirk, state geologist of New Mexico, has returned to Albuquerque from various trips over New Mexico, to the Mid-Continent oil field and to Yavapai County, Ariz.

Lieut. Percy E. Barbour, 22nd New York Engineers, managing editor of the "Engineering and Mining Journal," on leave, is editing the "Rio Grande Rattler," published in camp on the Mexican border.

Arthur E. Woolsey, formerly manager of the Tata Iron & Steel Co.'s steel works at Sakchi, India, who returned to the United States some months ago, has become manager of the plant of the Anniston Steel Co. at Anniston, Ala.

Arthur Redner has resigned his position as mining captain at the East Norrie mines of the Oliver Iron Mining Co., near Ironwood, Mich. He has taken a position as superintendent of the Anvil mine of the Newport Mining Co. at Bessemer.

Dr. D. B. Dowling, of the Department of Mines, Ottawa, has gone to Lethbridge, Alberta. He will endeavor to find an artesian water supply in southeastern Alberta. Three wells will be drilled in an area examined by Dr. Dowling last year.

H. A. Guess, managing director of the mining department of the American Smelting and Refining Co., has been elected a director of the New York & Honduras Rosario Mining Co. He is an additional director, the number of the board having been increased.

J. B. Risque has resigned his position as manager of the Tennessee Copper Co. and **N. H. Emmons** 2nd, has been appointed to the position. On account of this change, Mr. Emmons has resigned his position as secretary of the company and his address is now Copperhill, Tenn.

T. H. Jenks, who has been making his headquarters in Oatman, Ariz., for several months, has returned from a trip to Pittsburgh and New York, and is now examining copper properties near Las Vegas. N. M. He will then go to Wickenburg, Ariz., which will be his headquarters in the future.

Norman C. Stines has renewed his contract for three years with the same company with which he has been for the past three years, and has returned to Polevskoj, Government of Perm, Russia, to open up several prospects, besides managing the copper mines already developed under his management on the Sissert Estate. A shortage of men has made it necessary for him to work women in the mines, at times.

OBITUARY

Robert Strain, Jr., of Silver City, N. M., was killed Aug. 13 at the mill of the Burro Mountain Copper Co. by the overturning on him of a bucket of cresylic acid. He was 24 years old and graduated from Princeton two years ago, entering the Burro Mountain mill soon after.

William Watson Lawrence, a well known figure in New York's business world, died, Aug. 29, at his home, in that city. Mr. Lawrence was president of the National Lead Co. and was a director in the Assurance Co. of America, the Magnus Co., Inc., the Matheson Lead Co., the Seaboard National Bank and the United Lead Co. He was born in Huntington, Penn., Apr. 22, 1859, and was graduated from Princeton in 1878. His clubs were the University, Metropolitan, Riding, Automobile of America, Princeton, Westchester County, Duquesne (Pittsburg) and Maryland (Baltimore).

John Noey, aged 66, one of the oldest employees and also one of the oldest department superintendents at Andrew Carnegie's original steel plant, the Edgar Thomson Steel Works, Braddock, one of Mr. Carnegie's "junior partners," and widely known in the iron and steel business, died Aug. 23 at Pittsburgh. He was born in Johnstown in June, 1850, a son of John Noey, Sr., his father being one of the pioneer employees of the old Cambria Iron plant at Johnstown. He was a protege of the late Capt. William R. Jones. Mr. Noey had held the position of superintendent of boilers and of motive power at the Thomson Steel Works and blast furnaces for 42 years. He leaves a widow, two sons and two daughters.

SOCIETIES

Lake Superior Mining Institute—Secretary A. J. Yungbluth has announced that the 21st annual meeting will be held in Birmingham, Ala., Mar. 13 to 17, 1917. There will be no meeting this year because the mining men are too busy getting out ore to keep the furnaces going. The Institute members will assemble in Chicago and travel by special train to Birmingham, where five days will be spent looking over the mines and mills. The members of the Institute in the Birmingham district have promised that everything possible will be done for the entertainment of the visitors. The council of the Institute has voted the sum of $1,000 to aid in defraying the transportation expenses of the trip. It is believed that about 150 of the members will go south with the party. Many plan to remain in that section for several weeks, while some are figuring on a trip to Panama.

American Chemical Society—Official announcement of the meeting of the society, to be held in New York, Sept. 25 to 30, in conjunction with the Second National Exposition of Chemical Industries, was issued to the members by Dr. Charles L. Parsons, secretary, on Aug. 15. Dr. Charles H. Herty, of the University of North Carolina, president, will open the exposition on Sept. 25, with an address reviewing the history of chemistry and the chemical industries in this country and outlining developments since the outbreak of war in Europe. The presidents of coöperating societies, such as the American Electrochemical Society, the American Institute of Mining Engineers and the American Paper and Pulp Association will follow Dr. Herty with speeches of welcome and reviewing the progress made in the industries represented by them. The first general session of the American Chemical Society will open at Columbia University on Tuesday morning, Sept. 26, and arrangements are being perfected for a public meeting in the large hall of the College of the City of New York on Tuesday afternoon when addresses will be made of general public interest pertaining to the interesting developments in the field of applied chemistry during recent years. The program of the week's meetings will provide for general conferences on subjects in which the chemists of the country are now interested and it is intended that the lecture hall of the Grand Central Palace and Rumford Hall in the Chemists Club building will be occupied each afternoon at the same time by one or other of the different divisions of the society for the discussion of industrial topics. The American Electrochemical Society has planned a series of interesting meetings. The electrochemical group will open its meeting, Sept. 28, with a technical session devoted to a review of American progress in the electrochemical industry. A complimentary smoker will be held on Thursday evening and on Friday evening there will be a joint banquet at the Waldorf-Astoria.

Editorial Correspondence

SAN FRANCISCO—Aug. 23

Uniform Mine Taxation in the several counties of California is under consideration by the California Metal Producers' Association. A tentative plan has been prepared and informally discussed in a conference of the association with the State Tax Commission. But no action has been taken by either the association or the commission. Further consideration will be given the subject by the association committee and another conference held probably before direct action is taken by either body. The necessity for such a law is apparent. Producers operating in two or more counties are subjected to methods in one county entirely different to the methods in the others. It is not a difference in politics, but purely a difference in the individual notions of the assessors, who are governed by no fixed law in making assessments. There is probably no industry in the state that is subject to such irregularity and even unfairness as mining; and certainly there is none in which there is greater lack of uniformity in the taxing system.

Development of Minerals on Railroad Lands in Shasta, Siskiyou and Trinity Counties may be made possible as a result of the campaign in progress by the Northern California Counties Association to open to prospectors 1,300,000 acres of railroad land. Heretofore the prospector could only go on the land and prospect and develop minerals and metals by agreeing to pay to the Southern Pacific 15% of the gross product or buy the land at a price to be fixed by the railroad-company appraiser after the land was developed by the prospector. The improbability of profit to the prospector under such arrangement is obvious. The association of counties has succeeded after a long time in making it plain to the railroad company that the development of railroad lands will never be undertaken by mining men under these circumstances. Discussion of the legal or moral rights of the Southern Pacific or any other railroad company to hold these lands beyond the reach of the miner is not at present worth while. The railroads do hold the lands and evidently if the miner does not accept the railroad terms, he will have to keep off the railroad lands. The Southern Pacific land department has offered what is termed a concession to the prospectors in the three counties named. This offer provides that anyone discovering mineral, or having any reason to believe there is any mineral on any of the patented lands of the railroad, can obtain the right to operate in one of three ways: (1) Purchase outright for cash at a price which the railroad company will fix after examination and based upon showing of mineral, or the company will issue a short-time contract permitting mining until the contract is paid in full, a percentage of the value of mineral taken out to be credited on account of the unpaid part of the purchase price; (2) leasing for three years with renewal privilege each year, the amount of the same to be deducted from royalties; (3) leasing with purchase option at stated price. It is possible that the association will ultimately secure a wholly satisfactory arrangement with the railroad, but the miner is not likely to get much if the railroad company insists upon fixing the price after the prospect is opened, as suggested in the first method.

BUTTE—Aug. 24

Active Development at Davis-Daly mines is again in progress and increased production would have been accomplished by now had the new hoisting engine been delivered as scheduled. This is being delayed by a strike among the iron workers at Milwaukee. Everything is in readiness the moment the new engine arrives to put it into place and make the connections with the gallows frame. The new hoist will be operated by steam and will be able to handle ores down to the 4,000-ft. level. It is estimated that when it is running, production can be increased from the present output of approximately 175 tons of ore per day to from 400 or 500 tons per day. In the Colorado mine ore is being hoisted from the 1,400- and 1,500-ft. levels and from the 2,500. The second-class ore is running about 3½% and the first-class ore about 7% copper. While the last quarterly report showed a deficit of $18,000 due to expense of development work, the report for July is understood to show on the right side of the ledger. The indebtedness incurred for the new engine and for the development work now under way will be quickly taken care of by an increase in ore output.

Butte Miners Are Well Satisfied with the treatment they have received at the hands of the mining companies and the lesson learned, since the inter-union troubles, that they are better off without a union. They are cautious and suspicious now of anything that smacks of unionism. James Lord, president of the mining department of the American Federation of Labor, on his return from the recent labor convention at Great Falls, stopped in Butte to discuss unionism with Butte miners. He favored the open-forum plan by which men of each mine work out their own destiny in local affairs. There would be a local due and the local members would control their own finances. The local would correspond to a city. The next higher administrative body would be the district organization to control the affairs of the whole district. The final administrative power would be the national organization which could not, however, interfere with local affairs. Whether the Butte miners are ready to adopt such or any other plan for forming a new union, is doubtful. It will take some time to convince them that any benefit could accrue to them from such a step. Their experience in past years of being mercilessly fleeced of their hard earnings by the Western Federation of Miners without ever receiving anything in return for their sacrifices has made too deep an impression to be wiped out by any glowing promises on the part of another labor leader. The fact that since the breaking up of the local union the men have received the same and better wages than ever without being compelled to support a horde of agitators, will make them think long and hard before they will willingly submit again to such tyranny. Mr. Lord, by the way, was one of the speakers at the assembly in Miners' Union hall at Butte in June, 1914, which broke up in a riot and ended in the dynamiting of the property with the intent of ending the régime of Moyer and his henchmen.

DENVER—Aug. 24

State Compensation Insurance Fund completed its first year of business on July 30, 1916. Up to June 30, the metal mines insured in the Fund paid premiums amounting to $62,963. An amount equal to 12 per cent. of the premiums paid, or $7,555, has been credited to the next premiums, indicating a net cost of $55,407 for the 11 months of insurance. It is figured that the same operators would have paid $76,009 for this insurance at stock-company rates, and that the difference of $20,601 represents the saving made by the operators insured in the fund. This saving is about 27% of the cost of stock-company insurance. Ten per cent. of the premiums has been contributed to the surplus of the Fund according to the law. The Fund has become one of the large carriers of compensation insurance in the state. Up to June 30, it had collected $120,542 in premiums, of which $86,052 was from private business concerns. Accidents to employees covered by State Fund policies total 650 up to July 1, 1916. Twelve of these accidents resulted in death. It is estimated that the total yearly compensation premiums in Colorado are about $800,000, of which about $250,000 represents premiums paid by coal-mine operators. The annual compensation premiums in Colorado, exclusive of the coal industry, are about $550,000, of which total the Fund has secured about 18 per cent.

SALT LAKE CITY—Aug. 24

Reorganization of Ohio Copper by bondholders is causing some dissatisfaction among former shareholders, who feel that they are entitled to more consideration than is to be given them under the proposed plan. The only recognition that Ohio shareholders get under this arrangement is the right to subscribe to bonds of the proposed new company at par. Sale of the mining property is to take place on Aug. 29 at the Salt Lake County courthouse.

Tintic Milling Co., at Silver City, is installing eight new roasters, and the enlarged plant should be in operation by October. Three Holt-Dern roasters have been in successful operation for some time, and the new roasters are of the same type. The fourth shipment of precipitates—valued at approximately $24,000—has been marketed from a partial cleanup of the mill. Operations are much smoother than heretofore. The mill is now treating daily 100 tons of low-grade siliceous ores from the Tintic district, and when the roaster installation is complete, the capacity will be brought up to 300 tons. The new roasters will replace the

Knight-Christensen type, which formed part of the earlier equipment. When the plant is working at capacity, the cost of operation will be materially reduced.

The Metal Output of Utah Mines for 1916 will break all previous records, as indicated by preliminary reports for the first six months. There will be a decided increase in copper, silver and lead. Zinc production from sulphide concentrate, and oxidized and sulphide ores, will not largely exceed the 1915 output, which amounted to 22,000,000 lb. of zinc. The gold production is not expected to increase to any great extent. Practically all of the lead-silver mines are producing a much larger tonnage than before. The year's output of lead from Utah in 1915 was 199,967,347 lb. More silver will be produced from the Bingham district, as the lead output from here will break all former records. Park City is also producing at more than the usual output. The new mills that have recently started treating tailings in that district will add to the production. Zinc ore is being mined in Park City, Bingham, Tintic, Promontory, Ophir and Dry Cañon. The copper production of the state it is believed will be approximately 225,000,000 lb., if the present production is maintained. Practically all the copper mines are working at capacity, and the Utah Copper is making improvements and additions at its mills. The smelters are well stocked with copper ores, and it is difficult to market some ores of this class not contracted for. With the increased rate of production and higher price of the metal, the value of the copper output will probably be nearly double that of 1915.

OATMAN, ARIZ.—Aug. 25

Rumors of Consolidations still persist and while no official news is given out, it is certain that additional holdings are being secured by important mining interests. Control of the Sunnyside and also of the Oatman Queen has lately been acquired by leading stockholders of the United Eastern. The Keith interests, who have been developing the Oatman Pioneer, have also been extending their holdings and the fact that these strong operators are increasing their interest in the district is regarded locally as the best evidence that the camp is to warrant permanent attention of the mining industry. Energetic development is now assured for a number of properties and this work will stimulate further independent development. [Later—Jumbo Extension Mining Co. of Goldfield, Nev., has optioned the Oatman United and United Southern in the Oatman district and the Secret Pass Gold Top in the Secret Pass district.]

ALBUQUERQUE, N. M.—Aug. 23

The Carocito Copper District, about 50 mi. southeast of Albuquerque, is attracting attention. Shipments from this district near Scholle, a station on the Santa Fe, are increasing in tonnage and value. These bedded deposits differ from most Western copper deposits of this type in that the half-dozen enriched horizons are mainly limey shale, and not sandstone. The ore is therefore easily crushed and usually contains excess lime. The beds are generally about 10 in. thick—varying from 3 to 25 in.—there being half a dozen such within a 100-ft. thickness. They have a slight inclination eastward—away from the Manzano Mountains—but evidently the copper has no genetic connection with the Manzano uplift. The copper showings run along a cliff for at least 10 mi., while the best prospecting area covers about 10 sq.mi. Nearly all the prospects are in hand-cobbing ore near the surface, but one has reached a depth of 72 ft. The last 61 ft. of this vertical shaft is in ore running above 7%—some of it 9½%—by carload lots. The ore is mainly malachite at the top, but grades into much azurite below, and is dominantly copper glance at the 72-ft. level.

AUSTIN, TEX.—Aug. 23

Ozocerite, and not paraffin, is reported by Dr. E. P. Schoch, professor of chemistry, University of Texas, to be the substance which drillers of the Thrall oil field complained sealed up the well-screens and prevented the flow of oil. Tons of this valuable material have gone to waste in the Thrall field since the beginning, it having been used to cover pipes crossing the roads, as fuel, and in other ways destroyed. The production of this material in the Thrall field is small now, since most of the wells have been exhausted.

Texas Has 87,367 Sq.Mi. of Undeveloped Land, on which no reports of a geologic nature have been published, according to Dr. J. A. Udden, director of the bureau of economic geology, University of Texas. The bureau is now undertaking a thorough study of the unmapped portions of the state—nearly one-third its area—with a view to accumulating data necessary to an adequate economic investigation of the whole state. Prof. F. L. Whitney and James P. Nash, testing engineer for the bureau, have just completed a survey of Hays County, noting the formations, the nature of the fault zones, the well records, etc. They are also locating road material, building stone, cement material, as well as clay suitable to the making of brick. Other counties will be undertaken during the year. During the last few years the bureau has made extensive observations in some of the territory, upon which there is as yet no published report, for the purpose of sufficiently reconnoitering the ground to secure the data necessary for a preliminary general map of Texas. Some of the unknown part of the state is being mapped by the U. S. Geological Survey. These data will be incorporated shortly in the general map and description of the geology of Texas, now in preparation by the bureau of economic geology.

JOPLIN, MO.—Aug. 26

The Labor Trouble Bogey is looming up again. The average basis price for the month of August was only $58.75, which indicates another 25-cent. cut in wages. This brings the machine man down to $3 a day, whereas four months ago he was getting $4.25. Wages for other workers are in proportion, and there are rumors that the men are planning to stand out against this latest cut. The fact that producers are considering a shutdown may have a helpful effect.

A Surplus of 23,000 Tons of Zinc Ore in the Joplin district is the finding of special representatives of the mine operators and owners represented in the Southwest Missouri Mine Safety and Sanitation Association. To this should be added about 2,000 tons of calamine being held in the Arkansas section. Following this report officials of the mine operators' association called a special meeting of operators and owners to be held Monday afternoon, Aug. 28, and the announcement contains this statement: "Owing to the large surplus of ore in the bins throughout the district, there is a very general sentiment in favor of a shut-down until this surplus is removed or considerably diminished."

TORONTO—Aug. 26

Further Destructive Bush Fires prevailed in northern Ontario during the early part of the week, sweeping over a large area of wooded country along the route of the Temiskaming & Northern Ontario Ry. and destroying many homesteads and at least 12 lives. The plant of the Casey Cobalt mine was burned.

"Embargo on Nickel" is the "sounding brass and tinkling cymbal" with which the Liberal party is expecting to win over the people of Ontario. This slogan has a patriotic flavor and all the extraordinary circumstances of the present period have fitted in capitally with the plans of the Liberal leaders to make the campaign on these grounds, as the popular mind does not stop to consider the facts nor that the local, Dominion and British governments adopted the only practical and efficient means of securing the supplies of nickel needed by Great Britain and her Allies during the present war. The success of the Liberal leaders in steering public opinion is clearly indicated in the by-election for the Ontario Legislature in the southwestern division of Toronto on Aug. 21. This constituency, always strongly Conservative, gave a majority of 663 for Hartley Dewart, the Liberal candidate, who made the refining of all nickel in Canada the principal plank in his platform, and assailed the policy of the Canadian and Ontario governments in the strongest terms. The tone of the press demanding an embargo on nickel ore grows more pronounced every day, feeling being intensified by the report of the safe arrival of the "Deutschland" and her cargo in Germany, and the prospect of further supplies of nickel being shipped to the enemy by submarines.

Labor in Canada is becoming a serious problem and from present indications it is not likely to improve to any great extent. A change in the recruiting system has been made by the Canadian government. This is a species of registration, recently authorized by an order in council, and is probably intended to be a palliative measure, but as it is only a system of issuing badges to men who are physically disqualified, or who are engaged in some necessary occupation, it will not relieve matters to any extent. This registration is a preparation for more strenuous recruiting without disturbing the necessary industries. The shortage of labor is felt in almost every industry, and is particularly noticeable in northern Ontario in the different mining camps. In Porcupine the shortage is making itself felt acutely and some of the smaller properties that are not very well organized find it impossible to get men. The shortage is, of course, due to the war, and to the large number of men that have gone to the front. The number of alien enemies that have been sent to the detention camps is also a contributing factor. It is probable that little relief will be experienced until after the war, and until that time the operators are faced with an inferior class of workmen, a serious shortage, and an undercurrent of unrest on account of the wage question. The commission appointed by the Canadian Department of Labor to investigate the differences between the miners and mine oprators of Cobalt consists of Judge Coatsworth, Toronto: A. F. Corkill, Copper Cliff, and Joseph Gibbons, Toronto.

The Mining News

ALABAMA

NOE-AXTON (Pyriton)—This newly organized company will erect 100-ton graphite mill.

ARIZONA

Cochise County

PEABODY CONSOLIDATED (Johnson)—This pioneer copper mine of the Johnson district is installing new hoist, compressor and drills to sink to greater depth. Mine opened about 25 years ago. Carbonate ore still being shipped but sulphide ore will now be sought. Incline shaft only 350 ft. deep. Shipping 2 or 3 cars weekly of 6 to 7% copper ore; silver 3 oz. W. G. Eberhardt, superintendent.

Mohave County

OATMAN GOLD (Oatman)—Company reports west drift in 330 ft. on 500 level; oreshoot 3 ft. wide assaying $14.50.

ESPERANZA (Oatman)—Active development started at this property. Outcrop traceable over a mile. Surface assays show gold.

LEXINGTON ARIZONA (Oatman)—At 126 ft. on the incline (about 110 ft. vertical) a crosscut was run through the vein of which 2½ ft. along foot wall was good ore. Woods brothers, of Colorado Springs, Colo., are interested.

Maricopa County

REID & DEVINE (Aguila)—West Bros. recently shipped carload of copper ore from these claims in Harqua Hala mountains.

GILA COUNTY CINNIBAR MINING (Phoenix)—Company developing recently purchased claims in Mazatzal Mountains. A 30-ton furnace contemplated.

PARADISE GOLD (Phoenix)—Company sinking new shaft; good milling ore recently encountered; mine 23 mi. from Phoenix in McDowell Mountains.

Santa Cruz County

DUQUESNE MINING AND REDUCTION (Duquesne)—Second unit of flotation plant will be completed in September, giving capacity of 150 tons daily.

Yuma County

SHAMROCK (Vicksburg)—Installing surface equipment purchased from Furlough Development Co. of Wickenburg.

CALIFORNIA

Amador County

AMADOR STAR (Plymouth)—Formerly known as the Rhetta; being developed by stockholders of the Argonaut. Vertical shaft about 500 ft. deep; at that point a crosscut will be run to the Rhetta ledge. Baylies Clark, superintendent.

PLYMOUTH CONSOLIDATED (Plymouth)—One drum of new hoist, weighing 13 tons, hauled from railroad station at Carbondale by 12-horse team.

Calaveras County

ROUGH DIAMOND (Angels)—Rich gravel reported at this mine on Central Hill channel. Shaft 62 ft. deep. L. J. Hutchinson and David Bard, owners.

STAR & EXCELSIOR (San Andreas)—Reported that W. N. Nuner has sold this copper mine to Eastern men for $35,000.

BUTTE DREDGING CO. (Murphy)—May install dredge near old town of Douglas Flat.

CALAVERAS COPPER CO. (Copperopolis)—S. M. Levy, manager, quoted as saying that flotation plant will be doubled, bringing capacity to 500 tons daily. Equipment will include 8-ft. Hardinge mill, 20-ft. Dorr thickener, 11 pneumatic-flotation cells and one 11.5-ft. Oliver filter. It is stated that concentrate from old method of treatment was never higher than 6% to 8% copper, while flotation has yielded a 15% product. New 3-compartment shaft completed to sixth level. New machine shop and rock crusher installed. Crushing plant will be able to handle 1,500 tons in 24 hr.

WESTERN MINES CORPORATION (37 Wall St., New York)—Issuing $600,000 convertible bonds to finance mining and developing operations in California. Officers are Maj. H. S. Howland, D. C. Demarest. A. F. Hughes, John Landers, A. J. Harwood, of California, and W. D. Wright and Joseph Diehl Fackenthal, of New York. Will operate the old Gwin mine in Calaveras County; develop further the Sierra Mines in Jim Crow Cañon, 4½ mi. from Downieville in Sierra County; and prospect a large low-grade deposit in Inyo County. A. F. Hughes, consulting engineer, will have headquarters at the Gwin mine, Fosteria, Calif.

Eldorado County

RISING HOPE (Placerville)—Ingersoll-Rand 10x10-in. air compressor and drills being installed on this deep-gravel mine on Webber Creek. Working tunnel to be driven. George W. Engelhardt, manager. Schuyler N. Warren, of 51 Exchange Place, New York, and associates, owners.

Nevada County

CHROME DEPOSITS in Lime Kiln and Wolf districts are now reported less extensive than first believed. Shipments from Bear River district also below estimates.

GOLDEN GATE (Grass Valley)—Reconstruction begun June 20 is completed and test runs made on tungsten ore. Capacity 60 tons in 12 hr. Ore will be shipped to mill from other counties. A 700-ft. tramway has been built to transport ore from railroad to hoist and thence to the mill.

Sierra County

ON SLATE CREEK, near Scales, débris dam of 4,000,000 cu.yd. capacity is under construction by Los Angeles men. In addition to their own hydraulic operations, will sell water and impound tailings of other mines. Karl Brehme in charge.

SIXTEEN-TO-ONE (Alleghany)—Injunction granted restraining Twenty-One Mining Co. from extracting ore from stope alleged to have been broken into on Sixteen-to-One ledge. Suit also filed for $100,000 damages for ore mined.

CITY OF SIX (Downieville)—On Alleghany-Downieville serpentine belt. Crosscut tunnel being run to tap payshoot 60 ft. below present shaft. Present 1,300-ft. lower tunnel may be extended. Hodgkinson & Henderson, of Los Angeles, owners. Sol Camp, in charge.

Trinity County

CHROME DEPOSITS owned by Henry Sims near Chinese station will be worked by S. W. Winsor under five-year lease.

RICH GRAVEL DEPOSITS reported on Emigrant Creek in New River district by A. F. Vincent and wife. Several good-sized nuggets have been taken out.

SURVEYS ON SOUTH FORK OF TRINITY RIVER up Hayfork Creek are being made, believed to be preliminary to railroad construction. State Highway Commission has surveyors in same region.

MANGANESE CO. (Wildwood, via. Beegum)—Second 5-ton motor truck hauling chrome ore from mines to Redding.

PAULSEN RANCH (Lewiston)—A reconstructed 5-cu.ft. bucket-elevator dredge is to be installed on Trinity River by the Trinity Star Dredging Co. Fred Paulsen, owner of the ranch, is a director.

McCORMICK (Jacksonville)—Preparations for reopening property. Compressor and drills will be installed. Huntington mill being overhauled and electric power will be substituted for gasoline.

COLORADO

Boulder County

LOGAN (Boulder)—High-grade gold ore opened in 400-ft. level by the Lucky Seven Leasing Co.

FAIRFAX (Salina)—The 300-ft. shaft being sunk 100 ft. Under lease to O. W. Kulp and Charles Walstrum.

YELLOW PINE (Boulder)—Rich silver ore in Vancleuse vein. Vein 3 ft. wide; ore runs about $100 a ton.

INTERMOUNTAIN TUNGSTEN MILLING CO. (Salina)—Mill nearing completion. Equipment includes rolls, jigs and tables. W. J. Blake, manager.

MOJAVE-BOULDER TUNGSTEN CO. (Sugar Loaf)—Equipping recently purchased Bracken mines for active development. N. H. Brown, manager.

DOSS (Wallstreet)—High-grade gold ore encountered in tunnel level; lower development to be commenced. May install compressor and other equipment. F. J. Kamm, manager.

TUNGSTEN METALS CORPORATION (Boulder)—Mill in Boulder Cañon nearly completed; being erected by Colorado Iron Works Co., of Denver. Thomas McSherry, superintendent.

UP TO DATE (Caribou)—High-grade silver ore recently shipped. Sorted ore assayed 3,000 oz. New 30-man bunkhouse erected; additional equipment being installed. John R. Wolf, manager.

GREAT BRITAIN (Boulder)—Several pockets rich gold ore opened in schist in this property; both native gold and tellurides found. Shaft down 65 ft.; rich ore in drift on 50-ft. level. Hoist and small compressor installed; additional equipment will be purchased by H. N. Williamson and associates.

Lake County

HOPE (Leadville)—Mine will be operated by lessees.

PENROSE (Leadville)—Completed enlarging of station at bottom of shaft.

HARVARD (Leadville)—Flume in Evans gulch to carry water across Harvard mine workings completed. Water in mine has decreased over 300 gal. per min. One sinking pump will now be dispensed with. Sinking of shaft will be resumed in near future. Development in Tip Top, Quadrilateral and Stars under way.

La Plata County

BESSIE G. (Durango)—Property on Junction Creek being developed by John Hickey and associates.

CROWN JEWEL (Durango)—Oreshoot carrying gold, silver and gray copper opened on Emerald claim.

COLUMBUS (La Plata)—Stated that large vein of milling-grade gold quartz opened at point 1,080 ft. from portal of exploratory tunnel being driven under workings of old mine. Mine owned by Hearst and Searles estates at different times; now owned by James Doyle, formerly of the Portland.

San Juan County

MAYFLOWER (Silverton)—Being worked under lease.

IOWA-TIGER (Silverton)—Shipping one car per day of lead concentrates assaying well in gold and silver.

BELCHER (Silverton)—Property in Belcher basin on Sultan Mountain will be reopened after long idleness.

Summit County

COLUMBINE (Robinson)—Lessee, while excavating for drain box, opened in floor of stope 3-ft. vein of rich gold-silver-lead ore.

COHOMACK MINING CO. (Breckenridge)—New flotation mill to treat ore of Puzzle mine completed; first car of concentrates shipped. Much low-grade ore developed. Mine was formerly large producer.

TONOPAH PLACERS (Breckenridge)—Crosscut being driven from bottom of Miller shaft in French Gulch to cut veins containing zinc and lead sulphides discovered in dredging that part of gulch. Company operating three dredges—in French Gulch, Swan and Blue Rivers.

IDAHO

Shoshone County

REX CONSOLIDATED (Wallace)—Tramway reconstruction and mill remodelling in progress. Ore production to begin in September.

TAMARACK & CUSTER (Wallace)—Rex mill no longer available. Reported to be negotiating for Frisco mill; also National mill at Mullan.

CONSOLIDATED MARSH (Burke)—Terms of 10-year lease of Federal's Mono, O'Neil and Russell claims provide expenditure of minimum of $40,000 to validate lease and not less than $2,500 monthly; when milling ore contains 9% Pb or less, royalty shall be 35c. per ton milled; for each unit of lead above 9%, royalty shall be increased 25c.; when price of lead is above 5½c., New York, royalty shall be increased 30c. per ton for each cent rise, fractions proportionately; on crude ore, royalty is 15% of net smelter returns when lead is 5½c., New York; 20% when price is 5½@7c. and 25% when price is 7@8c.; all ore is contracted to be sold to the American Smelting & Refining Co. Marsh Company pays all taxes and secures Federal against damage, liens, etc.

MICHIGAN

Copper

ISLE ROYALE (Houghton)—An eighth shaft in contemplation on south end of property.

WINONA (Winona)—Slight increase in production anticipated in near future. Difficulty in securing enough men continues.

CHEROKEE (Houghton)—Shaft continues to show good copper rock, bottom of shaft in same quality rock first opened in pit blasting.

AHMEEK (Ahmeek)—By October will have its eighth stamp head in operation, with possible daily rock tonnage of 5,700 tons; this output exceeded only by Calumet & Hecla and Copper Range Consolidated mines.

OSCEOLA CONSOLIDATED (Osceola)—Largest tonnage now coming from North Kearsarge shafts, especially Nos. 1 and 4; No. 3 or middle shaft a small producer operations having only been resumed in June; previously shutdown owing to boiler explosion in winter. South Kearsarge dwindling in tonnage, about 1,200 tons daily, though grade is maintained. About 700 tons daily are coming from No. 6 shaft of old Osceola; old No. 3 shaft put in readiness some months ago but shortage of men prevents production.

CALUMET & HECLA (Calumet)—Production and costs per pound of copper for Calumet & Hecla and its subsidiaries for first six months of 1916 were: Calumet & Hecla 35,693,436 lb., cost 11.45c.; Ahmeek, 11,461,195 lb., 9.59c.; Allouez, 5,137,907 lb., 10.37c.; Centennial, 1,269,697 lb., 12.89c.; Isle Royale, 6,035,766 lb., 13.09c.; Osceola, 9,791,439 lb., 10.12c.; Superior, 1,758,465 lb., 12.89c.; Tamarack, 3,446,425 lb., 14.67c.; White Pine, 2,190,472 lb., 10.57c.; total, 76,784,802 lb. Calumet & Hecla will distribute to shareholders its 20,000 shares of Tamarack, one share being given for each five shares of C. & H. stock. 100,000 shares of the latter being outstanding; acquisition of Tamarack thus considered finally abandoned.

MINNESOTA

Mesabi Range

FROM NASHWAUK over 10,000 tons of ore are being shipped daily. Normal crews working at the Crosby, Quinn-Harrison, La Rue, Mace No. 2 and Hawkins. I. W. W. leaders unable to make any further progress. There is no trouble west of Keewatin at present.

MISSOURI

Joplin District

YELLOWSTONE (Joplin)—Getting 20% zinc ore at 110 ft. Have 20-ft. face well developed.

DEFENDER (Miami, Okla.)—Plans spending $30,000 in drilling campaign between Miami and Commerce. Drills already at work.

CORRELL (Joplin)—Planning $20,000 tailing mill at Commerce, Okla., to handle tailings from the Golden Hen, Never Sweat and Queen City.

WEST VIRGINIA (Galena, Kan.)—Old Durston mill remodeled and started. Ore mainly from east field shaft, connected with mill by surface railway.

NATIONAL ZINC AND LEAD (Joplin)—Planning new 400-ton mill on south part of McCorkle Hill lease at Webb City. One mill on north end of this lease now making fine showing.

ST. REGIS (Duenweg)—Mill at No. 2 mine at Chitwood completed but has no water. Shaft sunk 20 ft. to 200-ft. level, through sheet ground, but obtained no water; sinking will continue.

BUMBLEBEE (Joplin)—Purchased the Blendeville mill and will move it to Missouri Lead and Zinc Co.'s ground. Three shafts in rich ore and fourth under way. Mine flooded eight years ago when land owners stopped pumps; 90 tons of concentrates made during last week of operation at that time.

MONTANA

Deer Lodge County

SOUTHERN CROSS (Southern Cross)—Ore shipments cut considerably, owing to repairs on hoist; chippy hoist being used for ore as well as for men and supplies.

Jefferson County

CRYSTAL COPPER (Basin)—Ore being shipped regularly from upper levels. Crosscut tunnel to open orebodies at depth, in hard silicious aplite and was only advanced 65 ft. last month with one shift; another shift to be put on soon.

Lewis and Clark County

MARYSVILLE GOLD (Marysville)—This property, which embraces 30 claims containing 430 acres, is being financed by the Eisenberg-Seligman interests and has been listed on New York Curb. Ore reported to average $12.

FRANKLYN (Helena)—During month ended Aug. 15, nine cars of ore were shipped, netting the Thomas Cruse Estate $6,150 98. Shipments smaller than usual owing to large amount of development being done at this mine in the Scratch Gravel district.

Madison County

SHAFTER (Virginia City)—High-grade gold ore opened. Will begin shipping soon; 1,000 sacks ordered.

CONREY PLACER (Ruby)—Increase in wage scale of 50c. per day adopted for men previously receiving $3 and$3.50.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Flotation statement for July shows 45,875 tons treated in this plant, producing 8,686 tons of concentrate valued at $48.83 per ton; cost $3.64 per ton of concentrate.

ANACONDA (Butte)—The Diamond mine closed Aug. 12 to Aug. 20, account accident to hoisting engine. Both cages went to the sump, two men were killed and two injured, and considerable damage was done the engine and engine house.

NEVADA

Elko County

JUDGE (Midas)—Hayes & Raymond have 2½ years' lease and will sink 200 ft. from tunnel level; new electric hoist to be installed. Last crushing at Elko Prince mill of 28 tons carried $120 per ton.

QUEEN (Midas)—Leasers on this mine in southern part of Gold Circle camp have good body of $16 to $20 ore at 200-ft. level and are hauling ore at an expense of $3.50 per ton to Rex mill which has been leased.

MIDAS MERGER (Midas)—Consolidation of Rico and Missing Link claims. Hoist and pump to be installed. Leasers working 100-ft. level. Recently 21 tons of high-grade ore were sent to Murray, Utah, and 80 tons lower grade to Elko Prince mill.

Esmeralda County

SILVER PICK (Goldfield)—Core drilling west of shaft indicates three separate veins giving encouraging assays.

CHAMPS D'OR (Hornsilver)—Hardwick & Reed lease opened ore on 100-ft. level for 40 ft.; assayed $75 per ton across 3 ft.

MILLER MOUNTAIN MINING CO. (Tonopah)—Organized in Tonopah to develop 15 claims on Miller Mountain near Candelaria.

FLORENCE (Goldfield)—Development on 530-ft. level recently opened 4 ft. of $35 ore in footwall of old Rogers' lease stopes. Flotation plant treating about 200 tons per day.

JUMBO EXTENSION (Goldfield)—More extensive development planned. Pres. Charles S. Sprague announced dividend for third quarter would be passed for purpose of building up larger cash reserve. Company in the field for new property.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 19 was 9,257 tons valued at $192,706, compared with 8,960 tons for week previous. Producers were: Tonopah Belmont, 2,971 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,950; Jim Butler, 850; West End, 828; Halifax, 199; Rescue-Eula, 150; miscellaneous, 109 tons.

JIM BUTLER (Tonopah)—July profit, $25,124 from 4,752 tons mined and shipped to Millers for treatment.

TONOPAH MINING (Tonopah)—July profit $26,763 from 8,019 dry tons; average value, $12.40; bullion, 111,565 oz., value, $94,485.

TONOPAH BELMONT (Tonopah)—Profit of $107,000 from July operations; 11,828 dry tons yielded 2,413.71 oz. gold and 235,045 oz. silver. Reports of favorable development at company's Surf Inlet property, about 400 mi. north of Vancouver, on Princess Royal Island, British Columbia.

Storey County

ANDES (Virginia)—Saved 28 cars of ore from development on 350 level.

HALE & NORCROSS (Virginia)—Completed reopening tunnel at 3,500-ft. point and started work at 3,900-ft. point.

MEXICAN (Virginia)—Mill received 426 tons of custom ore averaging $26.32 and 120 tons from Mexican storage piles averaging $10.74.

CONFIDENCE-CHALLENGE (Virginia)—On 200 level of Imperial shaft advanced east crosscut to 114-ft. point and saved 10 cars of low-grade ore.

OPHIR (Virginia)—Sent to Mexican mill 16 tons of ore averaging $26.02 from 2,500 level. North drift on 2,700 level is in quartz and dacite at 285-ft. point.

UNION CON (Virginia)—Extracted 410 tons of ore: 2,400 level, 198 tons averaging $22.09; 167 tons, $29.93; 35 tons, $19.73; 2,500 level. 10 tons, $15.28. Continued reopening 2,300 station of shaft; repaired southeast drift on 2,400 level to the 220-ft. point; south drift advanced 25 ft. (produced 35 tons ore).

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—After examination of old Giroux mill by John M. Callow with view of rehabilitation as flotation plant, it has been decided to expend $100,000 in remodeling plant. Contract let to General Engineering Co., of Salt Lake City; mill to be operating by first of year. Instead of further churn drilling, Morris No. 2 shaft will be sunk 200 ft. to get under orebody of the Morris. Brooks and Bunker Hill areas.

NEW JERSEY

Bergen County

TENNESSEE COPPER (Ridgefield Park)—Phenol plant has resumed work after shutdown of several months.

Sussex County

OGDEN MINE (Edison)—Owen Conly has several diamond drills at work to test the possible existence of another orebody at lower depths. The older known orebody was worked out, and nothing has been done since Thomas A. Edison made an attempt to concentrate the low-grade material. Mr. Conly was superintendent of the mine 40 years ago.

NEW MEXICO

BATOPILAS MINING CO., 50 Broad St., New York, amended charter Aug. 3 authorizing management to conduct mining operations outside of Mexico. A property in New Mexico is being investigated.

Grant County

HANOVER BESSEMER IRON AND COPPER CO. (Fierro)—Construction of first 400-ton unit of concentrating mill will be started soon. B. E. McKechnie, manager.

Socorro County

GOOD LUCK (Mogollon)—Lauderbaugh & Thorlston, owners, have driven 250-ft. crosscut adit encountering contact at depth of 170 ft. Adjoins Confidence-Last Chance-Deadwood vein systems.

SOCORRO MINING AND MILLING (Mogollon)—At the Pacific mine, practically all equipment and lumber delivered for aërial tramway to Socorro mill; terminal stations, ore bins, etc., nearing completion; designed to deliver 75 tons daily.

MOGOLLON MINES CO. (Mogollon)—New three-compartment, 6x16-ft. shaft now 850 ft. deep. Company is erecting board flume to carry tailings through town of Mogollon and it is intended eventually to extend it to tailings dams about 4 mi. down creek.

PENNSYLVANIA

AMERICAN STEEL AND WIRE (Donora)—Reported that Donora Zinc Works has begun construction of zinc-oxide plant to treat distillery residues.

UTAH

Juab County

TINTIC SHIPMENTS for week ended Aug. 18 amounted to 188 cars; 173 cars for week preceding.

IRON BLOSSOM (Silver City)—Copper ore being shipped regularly but little siliceous ore is now marketed.

EMERALD (Mammoth)—Developing on 1,000 level west and north of shaft. Ground mineralized with iron, manganese, and quartz, carrying some silver and gold.

DRAGON CONSOLIDATED (Silver City)—Arrangements made for handling larger tonnage of iron ore. Copper ore of good grade being shipped. Daily output—largely iron ore—amounts to 230 tons.

EAGLE & BLUE BELL (Eureka)—Orebody cut in shaft at 1,832 ft. followed downward by shaft to 1,875-ft. point, where a station was cut. In sinking 20-ft. sump, good ore again encountered; gives vertical depth of 63 ft. thus far. Ore carries lead and silver. Water level thought to be at between 2,060 and 2,075 feet.

CHIEF CONSOLIDATED (Eureka)—About 150 tons weekly produced. Strike of importance made on 1,200 level, 300 ft. from other orebodies. Ore carrying lead and silver cut for 20 ft., and stoping started. The 1,800 level producing steadily, and ore extending up and down. Rapid progress being made in new shaft work under contract to Walter Fitch, Jr., at north end of property.

Salt Lake County

MONTE CRISTO (Salt Lake)—Developing on 100 level. Adjoins the Cardiff. C. A. Quigley president.

MILLER-PERUVIAN (Alta)—Ore carrying gold, silver, and lead mined at depth of 240 ft. Car at sampler. Property on south side of Little Cottonwood Cañon, west of South Hecla and Sells.

EMMA COPPER (Alta)—Prospecting by diamond drilling in coöperation with Emma Leasing Co. First hole down 500 ft. from Bay City tunnel. Hoped to find continuation of old Emma orebody beyond fault. Downthrow side thought to be to the northeast. Some iron pyrite encountered at 302 ft.

CARDIFF (Salt Lake)—Third dividend 25c. declared payable Sept. 1, making total of $375,000. Shipments held down to 100 tons a day owing to transport difficulties. Transportation by caterpillar engines and train not entirely satisfactory owing to steep grade. Additional trucks to be put on. Large tonnage of ore accumulated.

Summit County

PARK CITY SHIPMENTS for week ended Aug. 18 amounted to 2,832,670 lb. Silver King Coalition, Silver King Consolidated, Judge Mining & Smelting and Daly West had the largest output in the order named. Other shippers were the Ontario, Daly, and New Quincy.

KEYSTONE (Park City)—Will be reopened.

DALY WEST (Park City)—July output largest of any recent month.

ONTARIO (Park City)—Active development in progress and ore being mined. Frank Fleischmann, foreman.

DALY-JUDGE EXTENSION (Park City)—New shaft down 90 ft.; rock mineralized with some silver and lead.

DALY (Park City)—Special meeting will be held in Salt Lake, Sept. 11, to consider reducing capital stock.

PARK CITY MINES (Park City)—This company, leasing in the American Flag, shipped two more lots of ore (60 tons) from stopes on 1,000 level; ore carried gold, silver and small amount of lead. Developing vein recently crosscut on 700 level.

BIG FOUR EXPLORATION (Park City)—Mill at Atkinson treating approximately 600 tons of tailings daily. Plant recently enlarged to 750 tons capacity, but certain minor changes necessary; expected soon to reach normal capacity. Company has under lease until 1924 tailings dump—3½ mi. long, from 200 to 900 ft. wide, and up to 5 and 8 ft. in depth—estimated at over 1,000,000 tons, carrying about 0.015 oz. gold, 3.2 oz. silver, 1.6% lead and 4.1% zinc. Lead-silver and zinc concentrates are being produced.

Tooele County

WEST MERCUR MINES (Mercur)—May enlarge mill from 100 to 150 tons in near future. Plant working one month cyaniding gold ore along lines formerly used by Consolidated Mercur. Property embraces 240 acres which are to be prospected.

WASHINGTON

NORMAN MINES CO. (Northport)—Will construct at once new mill after plans of H. W. Newton. Fines will be treated by flotation.

WISCONSIN

Zinc-Lead District

GRAND VIEW (Benton)—Has begun shipment of zinc concentrates from Kearns mine at Benton.

WICKS (Mineral Point)—New company operating the Wicks at Linden has also taken over the Senator mine at Mifflin.

WISCONSIN ZINC CO. (Platteville)—The C. A. T. mill is completed; construction of Longhorn mill begun at New Diggings.

KISTLER & STEPHENS (Platteville)—Weigle tract, proved by drill, recently purchased at $250 per acre; will be opened by shaft.

LINDEN ZINC CO. (Cuba City)—Has rebuilt the Campbell roasting plant, adding two new kilns and seven Campbell separating machines, with Dings' feed attachment, increasing capacity from 200 to 450 tons of green ore per week.

CANADA

British Columbia

FLORENCE SILVER (Ainsworth)—Contract let to Broderick & Bascom Rope Co., of St. Louis, Mo., for 1,400-ft. aërial tramway from tunnel portal to new 250-ton mill now nearing completion. Hydro-electric equipment being delivered. Ferdinand R. Wolfle, of Spokane, Wash., president.

Ontario

COBALT ORE SHIPMENTS for July are reported by Arthur A. Cole, mining engineer for Temiskaming & Northern Ry., as follows: Beaver, 23.33 tons; Buffalo, 70.55; Cobalt Comet, 61.53; Coniagas, 70.12; Crown Reserve, 91.07; Kerr Lake, 93.53; La Rose, 135.15; McKinley-Darragh, 201.39; Mining Corporation of Canada (Townsite-City), 107.31; Nipissing, 131.95; O'Brien, 31.77; Temiskaming, 60.52; Trethewey, 41.94; total, Cobalt proper, 1,120.16 tons; Casey Cobalt (New Liskeard), 30.54; total silver-ore shipments, 1,150.70 tons. Alexo mine (Porquois Jct.), 671.15 tons nickel ore; Rand Syndicate (Temagami), 155.80 tons pyrites (69 tons previously reported as copper ore should have been classed as pyrites).

WEST DOME (Porcupine)—Will install electric driven plant to permit development on greater scale.

DOME (Porcupine)—On 700-ft. level, orebody is reported 440 ft. long and 240 ft. wide, averaging over $5 a ton. Second ball mill now in operation.

SCHUMACHER (Schumacher)—Orebody on 100-ft. level drifted on for 50 ft. and is now 30 in. wide, averaging $20 per ton. Crosscutting from 200-ft. level.

DOME EXTENSION (Porcupine)—What appears to be extension of Dome orebodies cut with diamond drill at depth of over 1,600 ft. in a 60° hole. Under option to the Dome.

TRETHEWEY (Cobalt)—At recent meeting, shareholders refused to ratify sale to Northern Customs Concentrator for $125 000. Company is making about $12,000 net a month.

OPHIR-PEOPLES (Cobalt)—Shaft being sunk on Peoples property under joint arrangement between the companies reached diabase; crosscutting started at 425-ft. level.

McKANE (Kirkland Lake)—In this property, worked under option by the Beaver of Cobalt, two high-grade veins have been opened on the 300-ft. level. Option will probably be exercised.

LA ROSE (Cobalt)—Has optioned Hurd claims in Kirkland Lake and will start work at once. Developments on Maidens MacDonald property in Porcupine, also under option, are satisfactory.

INTERNATIONAL NICKEL (43 Exchange Place, New York)—Will spend about $2,000,000 on new refinery at Port Colborne. Company now producing about 5,000,000 lb. of nickel and 3,000,000 lb. of copper per month.

BRITISH-CANADIAN NICKEL CO. (Sudbury)—New company to succeed British-America company in control of Murray nickel mine. Will proceed with power development on Wahnapitae River. Hybinette refining process to be used. Company reported to have contracted output to British government for 10 years.

AFRICA

Belgian Congo

UNION MINIERE du HAUT KATANGA (Elisabethville)—Copper production in July, 2,088 tons.

Union of South Africa

GOLD PRODUCTION IN TRANSVAAL in July is reported at 761,087 oz., which is 677 oz. less than in June, and 9,268 oz. less than in July, 1915. This is the first month this year in which the output has fallen below last year's figures. For the seven months ended July 31 the total was 5,178,403 oz. in 1915, and 5,392,954 oz.—or $111,472.359—in 1916; an increase of 214,551 oz. this year. The number of negro laborers in the gold mines in July was 192,130, a decrease of 679 from June. In addition 13,271 were employed in the diamond and coal mines, an increase of 51 over June.

The Market Report

Metal Markets

NEW YORK—Aug. 30

The metal markets all around were less active than in the previous week. Spelter in particular was dull and a declining tendency was exhibited. Copper was strong and advancing. Lead was quiet, but there were signs of more activity toward the close.

Since Monday all of the markets have been disturbed over anticipation of the railway strike, which threatens to tie up business in a multiplicity of ways that nobody ventures to forecast. Copper refiners have such stocks of crude copper and fuel that they can continue operations, but they will be hampered in deliveries, except for export. The smelters and manufacturers, not only of copper but also of lead and spelter, on the other hand, will be troubled in many ways.

Copper, Tin, Lead and Zinc

Copper—A pretty good business was done, but the volume was less than in the previous week. No export sales were reported, all the business being for domestic account, but some of the copper that was sold is going to be exported subsequently in manufactured form. There was no demand for September copper and scarcely any for October. The major market continued to be for November-December delivery. Some of the producers having filled their books for that period, the business went to those who could still supply that delivery and they were able to get better prices, the demand being fairly urgent. Other producers began to sell for December-January and January delivery, taking such business at concessions from present prices, but such transactions were not general. However, it appears likely that within a week or two all producers will have disposed of all of their copper available for delivery this side of December and the major market will become for December-January delivery.

The negotiations with the representatives of the allied governments for a large quantity of copper to be delivered during the first half of 1917 have been dropped. The reason was failure to agree upon price. We suspect that the dropping of the matter was due to the withdrawal of the producers, who saw their books becoming practically filled for 1916 and large demand looming up in other quarters for 1917 at better prices than were offered to the Allies when the negotiations were opened.

Copper Sheets are 37½c. per lb., base price, for hot rolled, and 38½c. for cold rolled. Copper wire is 31@32c. per lb. at mill for large lots.

Copper Exports from Baltimore for the week included 1,456,140 lb. to Great Britain; 3,000,000 lb. to Archangel, Russia.

Copper exports from Atlantic ports in August are estimated on the basis of custom returns at 27,700 gross tons. Exports from Gulf and Pacific ports will run probably up to 7,000 tons.

Tin—This market was very quiet and changes in price were insignificant.

Imports of tin into the United States in June were 4,949 gross tons in 1915, and 8,941 in 1916; increase, 3,992 tons. Reëxports of foreign tin were 72 tons in 1915, and 10 tons this year.

Tin exports from the Federated Malay States, seven months ended July 31, were 26,862 gross tons in 1915, and 25,224 in 1916; decrease, 1,638 tons.

Lead—During the early part of the week this market was more quiet and there was a tendency for the premiums over the price of the principal producer to disappear. However, they were still realized in some cases right through the week. This appeared to be chiefly a matter of the delivery that was wanted and could be supplied. In most cases the producers had sold themselves out for September. In other cases producers who were not in a position to command premiums for early delivery met the price of the principal producer and then made sales, this happening in the latter part of the week. The A. S. & R. Co. kept out of the market except for the supply of its regular customers. During the last two days decidedly more inquiry was reported, including some for round lots for export.

Exports of Lead from the United States in June were 14,977,496 lb., of which 644,073 lb. were produced from foreign ores.

Spelter—This market was extremely dull, producers reporting nothing but trifling sales, and quotations therefore reflect offerings rather than sales. From all quarters spelter was steadily offered at concessions.

The spelter market at present is of a see-saw character. When the price gets down to about 8c., sellers withdraw, and when it gets up to about 9c., buyers disappear. Producers express themselves as expecting a renewal of demand at around 8 cents.

Exports from Baltimore for the week included 224,110 lb. spelter to London. Imports included 7,592 tons zinc ore from Spain.

The zinc output of Japan in 1915 showed an increase of 206% over 1914, according to a recent consular report. The completion of the plants of the Osaka Zinc Industry Co. and the Miike Zinc Refining Works during the year was largely responsible for this increase.

Zinc Sheets continue unchanged, the base price being $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Sales are good and there are some heavy inquiries for export.

Other Metals

NEW YORK—Aug. 30

Aluminum—Business has been good and there is some pressure to buy, chiefly from automobile makers. Quotations are a little firmer at 60@62c. per lb. for No. 1 ingots, New York.

Imports of aluminum into the United States in June were 649,465 lb., against 1,786,889 lb. in June of last year.

Antimony—The abatement of the excitement that developed a fortnight ago continued, and the price receded further. We quote 12c. as an average for the business of the week. It is doubtful if so much could have been realized on large lots. The market is nervous. When a buyer appears the price goes up 3 to 5c., but after he has been satisfied it falls back again. Some producers ask 14@15c., but those are merely nominal asking prices.

Imports of antimony into the United States in June included 1,755,817 lb. in 1,235 tons of ore, and 4,960,751 lb. metal and regulus; a total of 6,716,568 lb., against 1,564,579 lb. in June of last year.

Quicksilver—This market was stronger. There were reports of sales of several hundred flasks for export. We quote $77, New York. San Francisco reports, by telegraph, $75, demand improving.

Exports of quicksilver in June were 72,745 lb., against 2,748 lb. in June of last year. A shipment of 42,000 lb. to England is reported this week.

Nickel—Business is good and prices are unchanged at 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Imports of nickel ore and matte into the United States in June were 5,064 tons, containing 6,246,176 lb. nickel, an increase of 1,800 tons ore and 2,231,785 lb. nickel contents. Exports of nickel, oxide and other products were 2,290,631 lb., a decrease of 1,492,369 lb. from June of last year.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Aug. 30

Gold continues to come into New York in considerable quantity, chiefly from Canada.

The Kolar goldfield in India reports gold production in July at 45,146 oz. For the seven months ended July 31 the total was 32,462 oz. in 1915, and 311,677 oz.—or $6,442,363—in 1916; a decrease of 12,943 oz. this year.

Gold production in the Transvaal in July was 761,087 oz. For the seven months ended July 31 the total was 5,392,954 oz., or $111,472,359, an increase of $4,434,769 over last year.

Platinum—The improvement in the demand continued. Early in the week sales were made at $65, compared with $62½@65 at the close of the previous week. The advance went further, sales being made at $70 and then $75. At the close $80 was asked. We quote the average for the week at $65@75.

Our Russian correspondent writes that the market and prices are strong, with a good demand for both domestic and export business. Demand for small lots from producers is active. The quotations at Ekaterinburg are 18.20 rubles per zolotnik; at Petrograd 69,000 rubles per pood, both for crude metal and 83% platinum. These prices are equal to $68.43 and $67.62 per oz. respectively.

Silver—The market has remained steady with upward tendency. Continued buying for coinage together with orders from India and smaller

SILVER AND STERLING EXCHANGE

Aug.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	Aug.	Sterling, Exchange	Silver: New York, Cents	Silver: London, Pence
24	4.7575	66⅛	31⅛	28	4.7575	66⅛	31 1/16
25	4.7575	66⅛	31 1/16	29	4.7575	66⅛	31 1/16
26	4.7575	66⅛	31⅛	30	4.7575	67⅛	32

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Copper: Electrolytic	Tin: Spot.	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
	26⅛	38⅜	6.50	6.40	8.75
24	@27	@38⅝	@6.62½	@6.50	@9.00
	26⅛	38⅜	6.50	6.40	8.62½
25	@27	@39	@6.60	@6.50	@8.87½
	26⅛	38⅞	6.50	6.40	8.50
26	@27	@39	@6.60	@6.50	@8.75
	26⅛	39⅛	6.50	6.40	8.50
28	@27⅛	@39⅛	@6.60	@6.50	@8.75
	27⅛	39⅛	6.50	6.40	8.50
29	@27⅛	@39⅛	@6.60	@6.50	@8.75
	27⅛	38⅞	6.50	6.40	8.37½
30	@27⅛	@39	@6.60	@6.50	@8.62½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Aug.	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic	Tin: Spot	Tin: 3 Mos.	Lead: Spot	Zinc: Spot
24	109½	107⅜	129	170	171	30¼	57
25	110	108	129	170¼	171¼	30¼	58
26	....	....	....	....	....	....	....
28	111	109	129	172¼	173⅜	30¼	58
29	110	108	129	173	173¾	31	58
30	110	108	129	171	171¼	31¼	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

arrivals of spot silver, have tended to raise the price.

The market in China continues bearish and exchange rules below parity. Market closes steady at 32d. bid in London.

Quotations for Mexican dollars in New York are reported Aug. 24 at 51@55c.; Aug. 25 at 51@55c; Aug. 26 at 51@55c; Aug. 28 at 51½@55¼c.; Aug. 29 at 51½@55½c.; Aug. 30 at 51½@55½ cents.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 26—Price quotations, per 2,000 lb.: Blende, high, $71 95; per ton 60% zinc, premium ore, $70; medium, $65@55; low, $50; calamine, per ton 40% zinc, $40@30. Average selling price, all grades of zinc, $65.26 per ton.

Lead, base price, $65@70 per ton 80% metal content. High price, $68.25; average selling price, all grades of lead, $65 08 per ton.

Shipments of the week: Blende, 5,848 tons; calamine, 144 tons; lead, 1,090 tons. Value, the week, $461,990; the year to date, $25,754,270.

This week's shipment exceeds the production about 1,000 tons, further reducing the stock, now well picked over for choice ore, leaving a residue largely composed of ores below medium grade.

One or more mines are forced to close each week from lack of water for wet concentration, but their production is replaced by new mills or the restarting of renovated and enlarged mills.

The Cherokee Smelting Co.'s works at Bruce, the Lanyon Smelting Co.'s and the American Spelter Co.'s works at Pittsburg are being closed down as fast as the new gas smelters at Quinton are ready to start; part of them is now being fired. The Nevada Smelting Co.'s plant at Nevada is being closed down as the stock of ore is diminished. The Missouri Co, at Rich Hill, is having labor troubles.

Platteville, Wis., Aug. 26—Quotations of the district are according to the following figures: Base price per 2,000 lb. ton for material assaying 60% zinc was $59 for premium ore down to $53 for medium grades. For material assaying 80% lead the base price advanced to $71 per 2,000 lb. ton.

Shipments for the week were 2,295 tons of zinc ore, no lead ore, and 886 tons of sulphur ore. For the year to date, the figures are: 79,022 tons of zinc ore, 2,787 tons of lead ore, and 18,357 tons of sulphur ore. Shipped during the week to separating plants, 4,358 tons of zinc ore.

Butte, Mont.—Butte & Superior produced 8,686 tons of blende concentrates in July, compared with 10.830 tons in June.

OTHER ORES

Manganese Ore Imports in Great Britain, seven months ended July 31, were 154,158 gross tons in 1915, and 259,309 in 1916; increase, 105,151 tons.

Imports at Baltimore for the week included 1,780 tons manganese ore from Brazil.

Pyrites—Imports at Baltimore for the week included 5,910 tons of pyrites from Huelva, Spain.

Tungsten Ore—The foreign demand continued, in connection with which several hundred tons were sold. This business was done at $17@18 per unit. Later about 100 tons were sold to domestic consumers at $18@20. The demand continuing both for domestic and foreign consumption, $20 was realized on Aug. 29. At the close we quote the market at $18@20.

Antimony Ore—No business was reported, which is not surprising in view of the situation in the metal.

Iron Trade Review

NEW YORK—Aug. 30

There is no material change apparent in the iron and steel markets. Export orders are still the chief feature though a fair domestic business is reported.

The chief increase in home orders is in structural steel for which more new contracts are noted. Mill production is delayed by the extreme hot weather.

Pig iron has been active with large sales reported, chiefly of basic iron. Prices have been rather variable, but with a tendency to advance.

Exports from Baltimore for the week included 464,820 lb. steel pipe, 375,138 lb. wire and wire rods, 498,678 lb. tinplates, 4,778,686 lb. steel billets and 1,908,480 lb. pig iron to Great Britain; 9,857,717 lb. steel rails and rail fastenings to France.

PITTSBURGH—Aug. 29

The steel and pig-iron markets have not reflected any material change that could be attributed to the imminence of a general railroad strike. Such a strike would affect consumers equally as to their receipts and despatch of products. A general strike would practically stop the production and consumption of steel. The blast furnaces usually carry no more coke than would be needed to bank and the furnaces would promptly bank and the steel works, shut off from pig iron and fuel and unable to ship their product, would necessarily close.

The steel market appears quiet, as it has since early in June, yet week by week the mills appear to be sold to a time farther ahead and from the mill viewpoint the whole situation is a very strong one. The large mills are sold up on bars and plates practically to the middle of next year and the pipe, wire and sheet mills for approximately the remainder of this year, while the tinplate mills will have to carry from one to two months of production over into the new years. The tinplate and sheet mills have not opened books for next year, although importuned by some classes of consumers to do so.

Finished-steel prices are very firmly maintained all along the line. Premiums for early deliveries are showing a slight advancing tendency and if the present extreme scarcity of unfinished steel continues some decided advances are to be expected before the end of the year. Present trends, however, may possibly not continue indefinitely as month by month the cheaper contracts for finished steel are being worked off and as consumers are forced to pay higher prices on steel received their consumption in certain directions may decrease materially. Many consumers insist strongly that they will have to curtail operations.

Pig Iron—The movement in foundry iron has broadened further and the market is quite active, with buying for the remainder of this year and the fore part of next year. Foundry iron at $18 25, Valley, has practically disappeared and the market is on a basis of $18 50, a price formerly obtained only occasionally. There is no general disposition to ask above $18.50, but some sellers are endeavoring to restrict sales at this figure to deliveries not later than Apr. 1, 1917. Basic iron at $18, Valley, hitherto the regular market, is claimed to be exhausted and $18.25 and $18 50 are asking prices, but no sales are reported at the higher level. About 5,000 tons additional of bessemer iron has gone at $21, Valley, and this grade is also regarded as scarce for the balance of the year. We quote: Bessemer, $21@21 50; basic, $18@18 25; foundry and malleable, $18.50; forge, $18, f.o.b. Valley furnaces, 25c. higher delivered Pittsburgh.

Steel—The market for unfinished steel is practically nominal, at about $45@50. It is difficult to find any steel at all at any price, while on the other hand, it is a question whether any large tonnages could be sold if the steel were available at the prices mentioned. The sheet mills could not afford to pay the price, for instance, while on the other hand the premiums obtainable for plates for prompt shipment would justify plate mills in paying $50 for slabs. Billets could probably be sold in limited tonnages at $45, perhaps at a shade more.

BIRMINGHAM—Aug. 28

The Southern iron market is stronger and inquiry brisker. Actual transactions are for small lots at $15, with some high sulphur and other low-grade metals under that basis. Stocks of resale metal went down 18,000 to 20,000 tons in July, and Tennessee metal is still offered under $15, Birmingham.

Export movement from Birmingham furnaces since July 15 has been over 25,000 tons. Spain took 500 tons of high-sulphur iron, and a shipment was made to Norway. Bulk of exports, however, is through Mediterranean ports.

Steel plants are groaning under shrapnel orders. The Anniston works are turning out shells rapidly, and shrapnel shapes are going out of Tennessee Co. mill at Ensley by thousands of tons.

Proposed advances of $2 per ton on coke and pig iron and of $6 on cast-iron pipe to Pacific Coast points, announced as effective Sept. 1, have raised a storm of protest. Commerce Commission is hearing them this week.

Coke is very strong, with standard beehive foundry remaining around $4.25 and $4.50, f.o.b. ovens, and furnace coke at $3.25 to $3.50. Demand for steam coal has picked up.

PHILADELPHIA—Aug. 29

A less heavy tonnage of steel was placed under contract in this district last week and less feverishness attended sales, but specifications against contracts with some of the larger mills were in greater volume than for several weeks. The market is still flooded with inquiries for steel to be used in the manufacture of war munitions, especially for export, exceeding 250,000 tons; but two of the largest eastern Pennsylvania companies, having sold their capacity for shell bars up to June and July of 1917, will no longer entertain such propositions, while a third mill steadily adheres to the attitude of reserve that it has maintained on shell steel since the beginning of the war. Shipyards and railroads have placed additional contracts for plates and shapes affiiregating between 30,000 and 40,000 tons. British interests closed for a moderate tonnage of marine steel for export to Hong Kong, and Japanese interests bid urgently for marine boiler plates. Several orders for forging and rerolling billets, aggregating probably 25,000 tons, were taken for domestic shipment. Foreign interests, still urgently in the market, found it difficult to buy either ingots or semi-finished steel in appreciable tonnages. The position of blast-furnace interests was further improved by more numerous small sales, larger shipments and reduced stocks, together with a substantial gain in inquiries for both steel-making and for foundry grades.

FERROALLOYS

Ferrosilicon is unchanged at $86@89 per ton at mill, according to quantity, for 50% alloy. Bessemer ferrosilicon is from $31 for 10% up to $41 for 16%, at furnace.

Spiegeleisen is quiet and unchanged at 40@45 per ton at furnace for 20%. For high grade—25@30%—$55@65 per ton is asked.

Ferromanganese—The market continues decidedly quiet. Contract is available at $175 as formerly and prompt lots bring about the same figure, there being no active demand.

Imports at Baltimore for the week included 1,854 tons ferromanganese from Liverpool.

FOREIGN IRON

French Iron and Steel Imports for three years are reported as follows:

	1913	1914	1915
Pig iron	32,669	15,885	166,709
Bars and plates	19,379	16,888	580,430
Machine steel	6,903	5,160	64,831
Sheets	13,760	6,652	76,230
Tin plates	19,460	24,878	68,340
Wire	6,088	7,407	44,511
Rails	1,792	547	40,678

Of the total iron and steel imported in 1915 the United States furnished 43,770 tons.

IRON ORE

Shipments are being pushed in spite of bad weather. Some wild tonnage has been chartered to carry iron ore from Duluth to Lake Erie for the balance of the season at $1 per ton, net.

A considerable quantity of iron ore from the Lake Champlain district is now being shipped to Lehigh Valley furnaces in Pennsylvania. At present this ore is sent by rail to Albany, by barge down the Hudson and by rail from Elizabethport, N. J., to the furnaces. With the completion of the Champlain Canal improvement next year it will be possible to ship in large barges from Port Henry or Crown Point direct to Elizabethport.

British Iron Ore Imports, seven months ended July 31, were 3,666,789 tons in 1915, and 4,137,609 gross tons in 1916; increase, 470,820 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 408,060 net tons; shipments, 408,179 tons. Shipments of Greensburg and Upper Connellsville districts, 38,500 tons.

Connellsville—The market has not softened as was expected from the starting a fortnight ago of one-half the new byproduct plant at Youngstown. Possibly there was little coke released by the operation as the operators who formerly shipped coke to that point must now ship coal. Prompt furnace coke is bringing $2 80@2.90 and the stiffening coal market makes operators reserved about offering coke, so that $2 75 is now spoken of as the prospective asking price on contracts for the first half of next year.

British Fuel Exports, seven months ended July 31, in gross tons:

	1915	1916	Changes
Coal	25,871,707	22,379,578	D. 3,492,125
Coke	486,644	881,632	I. 394,988
Briquettes	750,755	817,614	I. 66,859
Bunker coal	8,499,198	7,589,900	D. 909,298
Total	35,608,304	31,668,724	D. 3,939,580

The bunker coal is coal shipped abroad for the use of steamships in the foreign trade, or delivered to such steamships.

Chemicals

NEW YORK—Aug. 30

The general market has been quiet and rather steady. The undertone is strong and there is an anticipation of increased activity in heavy chemicals.

Arsenic—Demand is not specially active, but supplies are only moderate and prices are steady. Quotations are unchanged at $6@6.25 per 100 lb. for both spot and futures.

Copper Sulphate—There is continued inquiry, chiefly moderate sized lots, and a fair business has been done. Quotations continue at $8@10 per 100 lb., according to size and terms of order.

Nitrate of Soda—Notwithstanding rather heavy receipts here prices have been well maintained. Quotations are $3 per 100 lb. for both spot and futures. Shipments from Chile for the seven months ended July 31 were; Europe, 756,700; United States, 729,800; total, 1,486,500 gross tons, an increase of 522,650 tons over last year.

Sulphuric Acid—No change is reported and sales are being made ahead freely. Buyers are paying about 1c. per lb. for 60-deg. acid, while 1½c. per lb. is asked for 66-deg. acid.

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18	.....	$1.00
Alta Silver, Nev.	Sept. 1	Sept. 25	0.03
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Blue Star, Ida.	Sept. 25	Oct. 21	0.02
Cash Boy, Nev.	Sept. 1	Oct. 15	0.01
Challenge, Nev.	Aug. 23	Sept. 13	0.05
Coal Creek, Ida.	Aug. 25	Sept. 26	0.005
Exchequer, Nev	Sept. 5	Sept. 26	0.03
Emerald, Utah	Aug. 15	Sept. 9	0.00½
Friend, Ida.	Aug. 26	Sept. 16	0.002
Great Bend, Nev.	Aug. 15	Sept. 20	0.01
Hector, Ida.	Aug. 7	Sept. 15	0.005
Idaho-Nevada, Ida.	Sept. 14	Oct. 14	0.002
Jacket-C.Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Jack Waite, Ida.	July 27	Aug. 28	0.01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0.01
Keweenaw, Mich.	Sept. 2	.....	1.00
Lucky Calumet, Ida.	July 20	Aug. 21	0.005
Nevada-Stewart, Ida.	Aug. 3	Sept. 2	0 003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida.	Sept. 9	Oct. 7	0.002
Ophir, Nev.	Aug. 16	Sept. 6	0.05
Paloma, Utah	Aug. 21	Sept. 9	0.01
Phedora, Ida.	Aug. 29	Sept. 29	0.001
Rico Argentine, Colo.	Aug. 17	Sept. 2	0.01
Rio Grande Gruhstake, Nev.	June 22	Aug. 31	0.002
Sandstorm Kendall, Nev.	Aug. 22	Sept. 26	0.01
Sells, Utah	Sept. 21	Oct. 7	0.06
Sixes, Nev.	Aug. 23	Sept. 8	0.10
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Springfield Tunnel, Calif.	Aug. 15	.....	0.05
Sunrise, Ida.	July 27	Aug. 28	0.002
Sunset, Ida.	Aug. 5	Aug. 26	0.0015
Tar Baby, Utah	Aug. 3	Sept. 4	0.01
Tyler, Ida.	Sept. 12	Oct. 12	0.0015
Umatilla, Nev	Sept. 18	Oct. 24	0.0025
Utah, United, Utah	Aug. 12	Aug. 30	0.01
West Toledo, Utah	Sept. 12	Oct. 3	0.01
Whale, Utah.	Sept. 5	Sept. 25	0.05
Wolf Mt. Copper, Utah.	Aug. 2	Sept. 6	0.005
Wonderful, Ida.	Aug. 30	Sept. 20	0.001

Stock Quotations

SAN FRANCISCO Aug. 28	Bid
Name of Comp.	
Alta	.03
Andes	.08
Best & Belcher	.05
Bullion	.01
Caledonia	.30
Challenge Con.	.03
Confidence	.15
Cons. Imperial	.01
Con. Virginia	.08
Gould & Curry	.03
Hale & Norcross	.06
Jacket-Cr. Pt.	.06
Mexican	.16
Occidental	.70
Ophir	.21
Overman	.04
Savage	.05
Seg Belcher	.02
Sierra Nevada	.25
Union Con.	.66
Utah Con.	.01
Belmont	4.15
Jim Butler	.84
MacNamara	.04
Midway	.19
Mont.-Tonopah	.26
North Star	.15
Rescue Eula	.23
West End Con.	.80
Atlanta	.09
Blue Bell	.01
Booth	.12
C.O.D. Con	.03
Comb. Frac	.06
D'field B.B.	.02
D'field Daisy	.03
Jumbo Extension	.49
Pitts.-Silver Peak	‡.12
Round Mountain	.42
Sandstorm Kendall	.05
Silver Pick	.14
Central Eureka	.09
Argo	.15
Aris. Central	.15
Big Jim	.90
Lazy Boy	.13
Oatman No. Star	.10
Tom Reed	1.60
United Eastern	3 87½
United Western	.08

LONDON Aug. 17	
Alaska Tre'dwell	£5 15s 0d
Burma Corp.	3 3 9
Cam & Motor	0 11 6
Camp Bird	0 8 6
El Oro	0 8 6
Esperanza	0 11 3
Mexico Mines	3 10 0
Nechi, pfd.	0 13 0
Oroville	0 17 0
Santa Gert'dis.	0 13 0
Tomboy	1 2 6

SALT LAKE Aug. 28	Bid.
Name of Comp.	
Alta Con.	‡.21½
Black Jack	‡.10
Colorado Mining	.15½
Crown Point	.02½
Daly-Judge	.75
Emma Cop.	.68
Gold Chain	‡.20
Grand Central	.66
Iron Blossom	1.57½
Lower Mammoth	.05½
May Day	.10
Opohongo	‡.01½
Prince Con.	1.45
Seven Troughs	‡.03½
Silver King Coal'n	2.95
Silver King Con.	3.35
Sioux Con.	.09½
Uncle Sam	.05
Yankee	‡.17

COLO. SPRINGS Aug. 29	
Acacia	‡.03¾
Doctor Jack Pot	.10½
Elkton Con.	.16
El Paso	.60
Findlay	.03½
Gold Sovereign	.06½
Golden Cycle	2.14½
Granite	.75
Isabella	.19½
Jack Pot	.05
Jerry Johnson	‡.03½
Mary McKinney	.28
Portland	1.65½
Vindicator	1.99½

TORONTO Aug. 28	
Adanac	‡.75
Bailey	.07½
Chambers Ferland	.17
Coniagas	4.75
La Rose	.60
Peterson Lake	.22
Right of Way	.05½
Seneca Superior	.25
T. & Hudson Bay	55.00
Temiskaming	.59
Trethewey	‡.21
Wettlaufer-Lor.	.11
Dome Exten.	.34½
Dome Lake	.43
Foley O'Brien	.55
Hollinger	27.90
Jupiter	.27
McIntyre	1.31
Newray	.59½
Porcu. Crown	.65
Preston E. D.	‡.03
Vipond	.38
West Dome	.39½

N. Y. EXCH. Aug. 29	Clg.
Name of Comp.	
Alaska Gold M.	13½
Alaska Juneau	7½
Am.Sm.&Ref.,com	97½
Am. Sm. & Ref., pf.	112½
Am. Sm. Sec., pf. A	94½
Am. Sm. Sec., pf. B.	85
Am. Zinc	33½
Am. Zinc, pf.	66½
Anaconda	85
Batopilas Min.	1½
Bethlehem Steel	484½
Bethlehem Steel, pf.	135
Butte & Superior	66½
Chile Cop.	20
Chino	51½
Colo. Fuel & Iron	47½
Crucible Steel	75½
Dome Mines	24
Federal M. & S.	16
Federal M. & S., pf.	39
Great Nor., ore ctf.	37½
Greene Cananea	45½
Homestake	130
Inspiration Con.	55½
International Nickel	40½
Kennecott	49½
Lackawanna Steel	75½
Miami Copper	34½
Nat'l Lead, com.	65
National Lead, pf.	113
Nev. Consol.	19½
Ontario Min.	6½
Quicksilver	2½
Quicksilver, pf.	4½
Ray Con.	24½
Republic I&S, com.	52½
Republic I&S, pf.	113½
Sloss-Sheffield	47
Tennessee Copper	24
Utah Copper	52¾
U. S. Steel, com	96
U. S. Steel, pf.	118
Va. Iron C. & C.	45

N. Y. CURB Aug. 29	
Beaver Con.	.41
Buffalo Mines	.85
Butte & N. Y.	1½
Butte C. & Z.	5½
Caledonia	.61
Can. Cop. Corpn.	1½
Cashboy	.04
Cerro de Pasco	36½
Con. Ariz. Sm.	1½
Con. Coppermines	2¾
Con. Nev.-Utah	.28½
Crystal Cop.	1 1/16
First Nat. Cop.	4½
Florence	.70
Goldfield Con.	.81
Goldfield Merger	.08½
Granite	.21
Hecla Min.	5½
Howe Sound	4¾
Jerome Verde	1½
Joplin Ore & Spel.	.59
Kerr Lake	4¾
Magma	15½
Majestic	.56½
McKinley-Dar-Sa.	.60
Mother Lode	.36½
Nevada Hills	.16
N. Y. & Hond.	15¾
Nipissing Mines	7
Oro	.03
Ray Hercules	3¾
Rochester Mines	.60
St. Joseph Lead	16¾
Standard S. L.	1 1/16
Stewart	.25
Success	.34
Tonopah	5 5/16
Tonopah Ex.	5¼
Tribullion	5/16
United Zinc	5
White Knob, pf.	1¾
White Oaks	5¾
Yukon Gold	2

BOSTON EXCH Aug. 29	Bid
Name of Comp.	
Adventure	3½
Ahmeek	99
Algomah	1½
Allouez	67½
Ariz. Com., ctfs.	9½
Bonanza	.25
Butte-Ballaklava	1½
Calumet & Ariz.	71½
Calumet & Hecla	574
Centennial	18
Copper Range	61
Daly West	2½
East Butte	15½
Franklin	8
Granby	86½
Hancock	13½
Helvetia	.25
Indiana	3½
Island Cr'k, com.	45
Island Cr'k, pfd.	88½
Isle Royale	28¾
Keweenaw	4
Lake	12½
La Salle	4
Mason Valley	2½
Mass	12½
Mayflower	3½
Michigan	3¼
Mohawk	88
New Arcadian	6½
New Idria	12
North Butte	21½
North Lake	1¾
Ojibway	1½
Old Colony	2
Old Dominion	69
Osceola	86½
Quincy	90
St. Mary's M. L.	73
Santa Fe	2
Shannon	8¾
Shattuck-Ariz.	28½
So. Lake	6¾
So. Utah	22
Superior	16
Superior & Bost.	3¾
Tamarack	37½
Trinity	5½
Tuolumne	40
U. S. Smelting	70½
U. S. Smelt'g, pf.	51
Utah Apex	3 11/16
Utah Con	14
Utah Metal	‡8
Victoria	3¾
Winona	4¾
Wolverine	53
Wyandot	1½

BOSTON CURB Aug. 29	
Bingham Mines	9¾
Boston Ely	.98
Boston & Mont.	.75
Butte & Lon'n Dev.	.62
Calaveras	5½
Calumet-Corbin	.02½
Chief Con.	2
Cortez	.40
Crown Reserve	.40
Davis-Daly	2½
Eagle & Blue Bell	1 13/16
Houghton Copper	1½
Iron Cap Cop., pf.	5½
Mexican Metals	.37
Mines of America	2½
Mojave Tungsten	3½
Nat. Zinc & Lead	1
Nevada-Douglas	1 1/16
New Baltic	1¾
New Cornelia	15
Ohio Copper	.C7
Oneco	.75
Raven Copper	.07
Rex Cons.	.20
Rilla	.16
United Verde Ext.	33½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	.....	25.979	22.780	.....
September	53.290	48.680	.....	24.260	23.591	.....
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	.....	151.440	.....
September	33.125	.....	152.625	.....
October	33.080	.....	151.554	.....
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	.....	4.520	.....	21.946	.....
September	4.610	.....	4.490	.....	23.151	.....
October	4.600	.....	4.499	.....	23.994	.....
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9 837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11 582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14 55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	.....	15.31	.....	14.75	.....
September	16.86	.....	15.95	.....	15.70	.....
October	16.95	.....	15.96	.....	15.80	.....
November	17 57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.83	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.

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